AVIATION WEEK

A McGRAW-HILL PUBLICATION

October 8, 1956 50 cents

Architect-Engineers' Role in Missile, Aircraft Industry



Helio Courier H-391B

Lockheed Electra's New Specifications

WIGGINS' NEWEST!

an automatic connection

SMALL SPACE REQUIREMENT

LOW PRESSURE DROP

NO AIR INCLUSION



Wiggins
connect-O-matic
Trademark

COUPLING

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POSITIVE

SAFE AND DOUBLE SAFE

ANY DESIRED SERVICE

PUSH...it's connected!

SINGLE, SIMPLE, MOTION

If it's got to connect
...connect with
WIGGINS

Manufacturers of

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Wiggins

E. B. WIGGINS OIL TOOL COMPANY, INC.
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Axelson in action



landing the hot ones

Two "hot" performers by Douglas . landing gear by Axelson

The DC-3/C-47, the plane that won't wear out, has been overworked and overloaded for more than 20 years . . . for 150 scheduled airlines in 70 countries . . . through two wars, in every theater of operation, in every major campaign and invasion. And over half of the 12,000 DC-3s built by Douglas have been equipped with Axelson produced shock struts.

Today, Axelson landing gears continue to prove themselves on Douglas "hot ones" like the F4D, the carrier-based high-altitude interceptor and world's record holder for the 3 kilometer and 100 kilometer courses. From a standing start, the bat-winged jet leaps to 10 000 feet in less than a minute. Mission accomplished, it touches down on Axelson produced landing gear.

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Division of U. S. Industries, Inc.

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Nine Sargent quality units have been selected to provide Chance Vought's F8U-1 Crusader with instantaneous, positive, feather touch response

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The experience of more than 36 years of design and manufacture of precision equipment systems has given Sargent Engineering Corporation the "know-how" to aid in solving the essential and advance problems of force control Leading airframe and missile manufacturers are using hundreds of different Sargent hydraulic, mechanical, pneumatic, electrical and electronic force control units on the nation's military planes, commercial planes and missiles.

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—[illegible] Supreme Court

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HUNTINGTON PARK, CALIFORNIA

BUILDS QUALITY THAT BUILDS GOOD WILL

AVIATION CALENDAR

Oct. 8-10—Third jointly sponsored annual Lubrication Conference of American Society of Mechanical Engineers American Society of Lubrication Engineers, Chalfonte Haddon Hall Atlantic City, N J

Oct 8-12—National Fall Meeting, American Welding Society, running concurrently with National Metals Exposition Hotel Cleveland, Cleveland, Ohio

Oct. 9-11—Second Joint Military Industry Symposium on Packaging and Materials Handling sponsored by USAF in cooperation with other services and Dept of Commerce Departmental and Dept. of Commerce auditoriums Washington, D C

Oct 10-12—Society of Automotive Engineers, National Transportation Meeting Hotel New Yorker, N Y

Oct 10-12-16—National Advisory Committee for Aeronautics' triennial inspection of Langley Aeronautical Laboratory

Oct. 11-12—Seventh Annual Noise Abatement Symposium Hotel Sherman, Chicago, Ill.

Oct. 15-16—National USAF Conservation Conference, Westward Ho Hotel Phoenix Ariz

Oct. 15-19—Second Annual Worldwide Conference of USAF flying safety officers, conducted by USAF Flight Safety Research Keesler AFB Biloxi Miss

Oct. 15-Nov. 21—Short course for aerial applicators, Ohio State University in cooperation with Ohio Aviation Board, Ohio State University School of Aviation, Columbus Ohio

Oct. 16-Nov. 2—Tenth Air Transportation Institute, American University Washington, D C

Oct 17-19—Annual Indiana Aviation Conference, sponsored by Indiana Aviation Trades Assn and Indiana Airport Officials Assn. Turkey Run State Park, Marshall Ind

Oct. 23-25—National Business Aircraft Assn Ninth Annual Meeting and Forum, McAllister Columbus Hotels, Miami, Fla

Oct. 25 26—Aircraft Electrical Society Annual Equipment Display, Pan Pacific Auditorium, Los Angeles, Calif

AVIATION WEEK • OCTOBER 8, 1956
Vol 65, No 15

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BOURNS now offers an expanded line of

TRIMPOTS®

...7 stock models of sub miniature potentiometers to serve many special needs—at no extra cost!

First there's the 120 Wirewound TRIMPOT, with features common to all other BOURNS TRIMPOTS. It's a 25-turn potentiometer, easily adjusted, and weighing only 0.1 oz. Rectangular in shape, it fits readily into miniature electronic circuits. You can mount it individually, or stack it compactly with standard screws. Mountings are interchangeable with those on all other TRIMPOTS

The self-locking shaft holds stable settings under extreme environmental conditions. All parts are corrosion resistant. Every unit is inspected 100% for guaranteed specifications. Resistances 10 to 20,000 ohms, with resolutions as low as 0.2%.

Now, to give designers greater latitude, BOURNS has developed and is manufacturing the following standard models—variations of the Model 120



120 TRIMPOT —*Carbon*
Infinite resolution is provided by the carbon element. Resistances are higher, ranging from 20,000 ohms to 1 megohm

130 TRIMPOT —*Solder Lug*
For wiring direct to the instrument using soldering iron or dip soldering techniques. Usable range of 98%

132 TRIMR —*Variable Resistor*
High resistance—up to 50,000 ohms in a wirewound rheostat.

209 TWINPOT —*Dual Potentiometer*
Two outputs electrically independent and controlled simultaneously by one adjustment

160 TRIMPOT —*High Temperature*
Operates at 175°C. High power rating 0.8 watt at 50°C

230 TRIMPOT —*Humidity proof*
Completely sealed, unit meets MIL-E-5272A Specifications for humidity

Write for literature on the BOURNS TRIMPOT line

BOURNS LABORATORIES

General Offices 6135 Magnolia Ave., Riverside, Calif.
Plants Riverside California—Ames, Iowa

DOW



Dow high temperature magnesium alloys have excellent fabrication characteristics

Lightweight structural metals with high strength, stiffness and elasticity at elevated temperatures! A new group of Dow magnesium alloys offers a great combination of these properties without the fabricating difficulties normally experienced with other high temperature materials.

Specially developed for use in airframes, missile and engine structures, the new alloys are already making weight reductions possible for several manufacturers. These alloys show advantages at temperatures up to 700°F. Limited test data on properties up to 800°F are available for some of them.

FABRICATION: Fabrication characteristics are equal to those of standard magnesium alloys.

WELDABILITY: 95 to 100% weld efficiency at elevated temperatures.

FORMABILITY: Single deep draws can be easily accomplished.

MACHINABILITY: Best machining characteristics of any structural metal.

One of the new alloys is magnesium-thorium composition HK31A. It is now available in rolled form from stock. Castings and sheet in mill quantities are also readily available. A companion alloy for extruded shapes and forgings will soon be in production.

For more information about the new high temperature magnesium alloys, contact your nearest Dow Sales Office or write to THE DOW CHEMICAL COMPANY, Magnesium Sales Department MA 362C, Midland, Michigan.



EASILY FORMED: These HK31A parts were drawn using production dies and processes for standard magnesium alloys. The parts retained a higher percentage of original properties than standard alloys.

you can depend on DOW MAGNESIUM DOW

communication navigation control

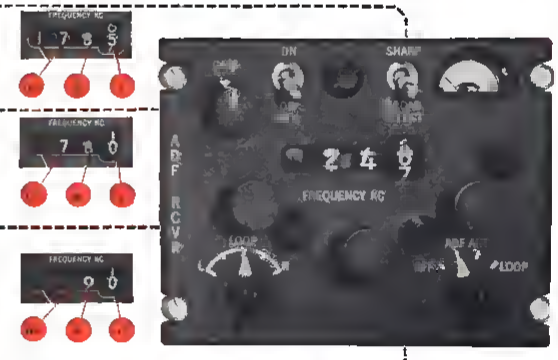
THE NEW ADF

OF COLLINS AIRBORNE ELECTRONICS SYSTEM

RANGE 1000-1800 KC
Rotate 100's knob until first two digits appear in 1000 and 100 kc dials. Next rotate 10's knob for third digit and units knob for fourth digit.

RANGE 100-999 KC
Rotate 100's knob until 1000 kc dial is blank and first digit desired appears on 100 kc dial. Next rotate 10's knob for second digit and units knob for third digit.

RANGE 90-99 KC
Rotate 100's knob counter clockwise to mask 100 kc and 10 kc dials. The latter mask is marked with the "9". Next rotate units knob until frequency appears on units dial. When units dial is rotated above nine, a plus sign appears in window, when rotated below zero, a minus sign.



Receiver Weight: 15.9 pounds
Total Tubes: 11
Receiver Space: ½ ATR
Antenna: Ferrite loop, 4 pounds

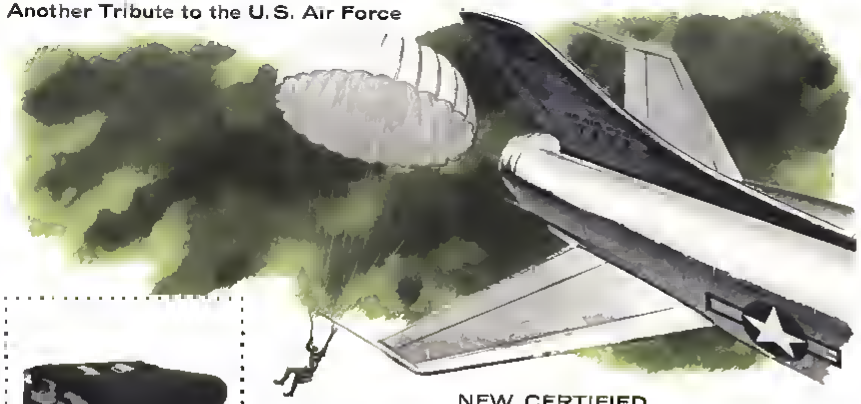
Simplified tuning for fast, precision frequency control is one of the improvements of Collins new Automatic Direction Finder system. "Searching for station" is an obsolete operation when using the easy-to-read counter-type dial of the control unit shown approximately actual size. Other distinguishing characteristics are reduction in weight and space, low power demand and improved reliability.

Write for the new ADF brochure

Collins CREATIVE LEADER IN AVIATION ELECTRONICS

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LTD. 242 London Road, Hayes, Middlesex

Another Tribute to the U.S. Air Force







NEW CERTIFIED

GLOBAL SURVIVAL KIT

OF KOCH FIBERGLAS IS ESPECIALLY DESIGNED FOR HIGH-ALTITUDE, HIGH-SPEED ESCAPE

Self-contained oxygen and pressure are automatic upon ejection Ejected pilots chances of survival following engine or structural aircraft failure have been dramatically increased by a new one-unit kit It is the first to supply both oxygen and pressure, and is designed for use everywhere in the world It was developed by H Koch & Sons for the Aero-Medical Laboratory at Wright-Patterson Air Force Base, Ohio

The 22-inch long kit, made of precision-molded Koch Fiberglas, fits into the bucket of the seat

Two seconds after ejection, the seat breaks away automatically, the kit remaining strapped to pilot, and a 20 minute, 70 cubic inch oxygen supply in the kit takes over When the pilot reaches an altitude where he can breathe without supplementary oxygen, he pulls the "disconnect" lever, and the oxygen mechanism breaks away as the kit drops twelve feet below him The kit opens, and a life raft inflates automatically Then the kit drops twenty-five feet below the pilot, thus landing before him, and relieving the chute of the weight of the kit The pilot is provided with a ready-inflated raft the moment he strikes the water He can pull in the kit and be on the raft in ten seconds

Other equipment vacuum-packed in the Koch Fiberglas Global Survival Kit is a radio, radar and sun reflector, rifle, fishing gear, water purifier, sleeping bag, food, basic first-aid supplies, and other "survival items" These were especially selected after exhaustive tests by a "Human Factors Group" of the U S Air Force

The radar reflector, molded into the Koch Fiberglas lid, is the first to be included in survival equipment and was created by Koch's Design and Development Department

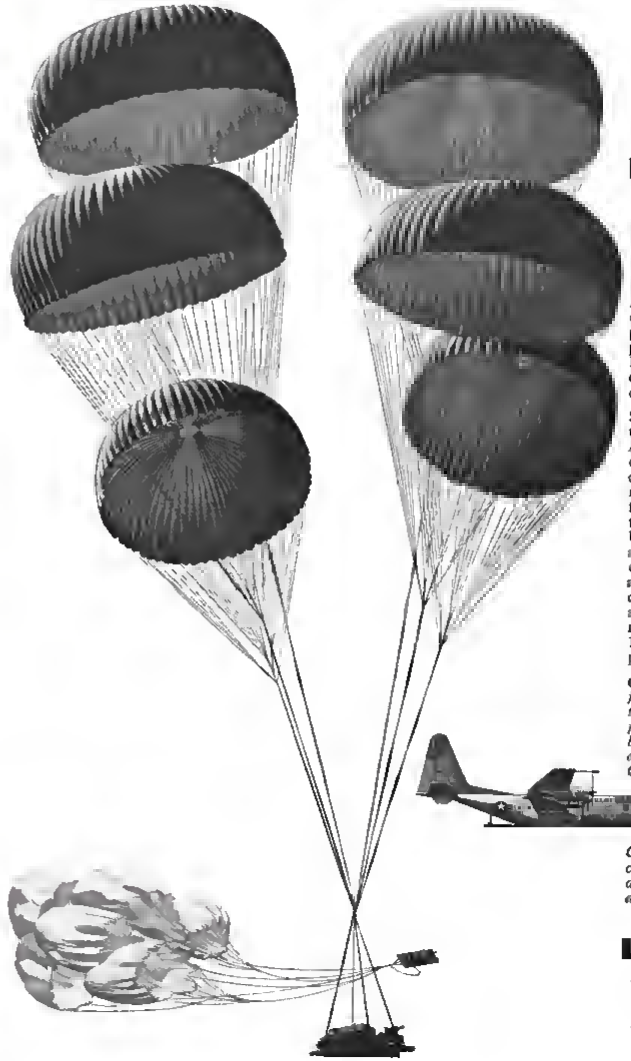
Very soon all Air Force jet aircraft will carry this Global Survival Kit as required equipment

Koch's contribution to life-saving survival equipment results from an intense interest in all aeronautical problems, plus pioneer experience in Fiberglas fabrication The Koch Fiberglas radome to house all weather aeronautical radar is one of many precision molded products Koch has developed to serve American aviation Whatever the needs of aviation — if Fiberglas can make it better, Koch will make it! Write for our tenth anniversary Manual of Fiberglas Fabrication

KOCH FIBERGLAS

(PRONOUNCED "KAKE"

Dept. AW-E, Carta Madera, California



C-130 HERCULES

PARARROPS HEAVIEST LOAD EVER DROPPED FROM AN AIRPLARE

A 27,000-pound load—the heaviest single load ever extracted by parachute from an airplane—was paradropped from the U S Air Force's new medium troop-and-cargo carrier, C-130 HERCULES, during recent aerial delivery tests

Soon to enter activa service with the 18th Air Force of the Tactical Air Command, the C-130 HERCULES made its record-breaking drop with a 27,000-pound load of iron—from an altitude of 2,000 feet. During the same series of tests, this new "strongman" of the USAF also established new all-time records for multiple-equipment drops from any type aircraft Sample combination drop: 19,000-pound road grader and 7,500-pound 40-mm-gun mount Heaviest multiple drop 18 containers totaling 29,000 pounds.

Capable of flying cargo and men farther, faster and at lower cost than any other present-day transport, the C-130 HERCULES *is now being manufactured in quantity at USAF Plant No. 6, Marietta, Georgia*

Challenging opportunities in aircraft and nuclear work are available for outstanding scientists and engineers Inquiries invited.

LOCKHEED

AIRCRAFT CORPORATION

Georgia Division, Marietta •

Look to Lockheed for Leadership

Close-Tolerance Superior Tubing Helps Make Accurate Heat Detectives



Thermocouple sheath made from Superior tubing is compressed by swaging (shown above). This crushes the ceramic inside the tube, forming a tight, solid insulator that holds the thermocouple wires firmly in place. Swaging also reduces the tubing to final correct size.

Marlin Mfg. Co., of Cleveland, came to Superior for help on a production headache with a new wrinkle. Wanted was tubing to sheathe thermocouples tubing in non-standard sizes and somewhat bigger than the finished OD of the thermocouples. Manufacture included swaging the tubing down to final size.

The headache was in trying to get tubing of precisely the right size so that the required swaging would not be so great as to break the thermocouple wires inside, or change their thermal properties, nor so little as to fail to pack the ceramic properly and prevent it from shaking out. The tubing had to be free of any ID contamination which would tend to carbonize inside the sheath, shorting out the thermocouple.

Superior's wide range of analyses and sizes of tubing, produced to standard tolerances or better, provided the answer. Marlin ordered tubing in four stainless analyses (AISI types 304, 310, 321 and 347) and in Inconel. Sizes ranged from .015 to ½ inch. All Marlin's specifications are being met from Superior's standard line, *without charges for production extras.*

Superior offers as standard tubing what many mills classify as special. So no matter what your small tubing requirements, specify Superior. Why not send today for literature of interest to your particular field. For general information, ask for Bulletin No. 40, Superior Tube Company, 2040 Germantown Ave., Norristown, Pa.



Some Marlin products using Superior tubing: (1) pressure rake. (2) Marlin thermocouple wire. (3) pitot static probe. (4) thermocouple rake ready for wire. (5) instrumented turbine blade. (6) shielded pressure probe. (7) claw probe for sensing direction of flow of gases or liquids.

Superior Tube

The big name in small tubing

NORRISTOWN, PA.

All analyses .010 in. to ⅜ in. OD—certain analyses in light walls up to 2½ in. OD

West Coast: Pacific Tube Company, 5710 Smithway St., Los Angeles 22, Calif. • RAymond 3-1331

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ROUTE CARD

From inspection of raw forging through many complex and precise operations to final protective packaging, every operation involved in the production of a typical Foote Bros. precision gear is performed completely within our plants by our people. Production is completely integrated and precisely controlled at every step . . . to give you quality and prompt delivery. Foote Bros. also has complete facilities and experience for design, process, manufacture and testing of items or assemblies to your specifications or to your complete design.

This trademark stands for the finest industrial gearing made!

FOOTE BROS.

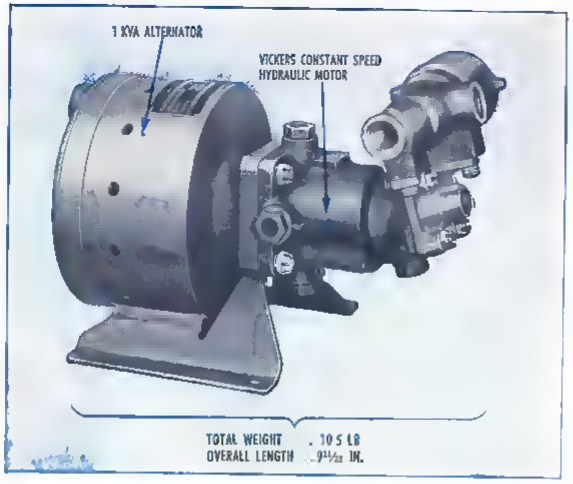
Foote Bros. Gear and Machine Corporation

4545 South Western Boulevard Dept. G-1 Chicago 9, Illinois

New Vickers Airborne Electrical Power Package

. . . Saves Weight and Space

Utilizes the Hydraulic System for More Efficient Production of AC Power



This new isolated electrical power package provides closely regulated AC power with minimum weight and envelope while drawing its power from a hydraulic system. In new designs or when adding electronic equipment to aircraft designs in which the electrical system is already loaded to capacity, this versatile package provides the needed AC power from flow available in the hydraulic system. This generally is permissible without system change as the full flow is seldom demanded except for a few seconds under rare circumstances. Even in such cases, full flow can be guaranteed to these hydraulic functions through the use of a simple priority valve which starves the AC power package momentarily.

Less Weight and More Efficient

Important weight savings are achieved through the use of this package instead of an inverter which may also require an increase in the AC generator and line capacities. In one instance, the 10.5 lb 1 kva package replaced a 38 lb inverter for co-pilot instrumentation. An additional advantage is that the package has 62% overall efficiency while that of the inverter was 35-40%.

Extreme altitude operation is no problem as the Vickers isolated electrical power package contains no brushes or other altitude-sensitive components.

Features of AC Generator

The permanent magnet type AC generator has excellent life and reliability. It requires no bulky voltage regulator . . . is inherently smaller and lighter than conventional generators due to the elimination of the exciter and slip rings. It also has higher overall efficiency resulting from elimination of all excitation losses. Additional advantages are that the permanent magnet is unaffected by momentary short circuit, or separation of field and armature without keeper, or by temperature cycling. It is also not susceptible to aging or shock. This unit is 120/208 volt, three phase, wye connected with 400 cps at 8000 rpm. It is capable of continuous duty under environments of 0-55,000 feet altitude and ambient temperatures from −65 F to 250 F.

Hydraulic Motor Drive

The generator is directly driven by a Vickers Constant Speed Hydraulic Motor having fixed stroke and an integral flow control valve that maintains an 8000 rpm speed setting within ±2¼% regardless of the load (as long as valve inlet pressure is greater than load requirement). For the unit shown above, maximum operating pressure is 3000 psi while rated output of 1 kva requires operating pressure of 2200 psi. Special configurations will maintain 400 cps frequency within ±0.1% regardless of load. This motor has a very high horsepower-weight ratio and its overall efficiency exceeds 92%. It is a time-proved design capable of many hundreds of hours of continuous service without attention.

Many Uses and Sizes

The applications for this isolated power source are numerous. For multi-engine aircraft, its use for co-pilot instruments provides dual reliability. This package has been used to supply controlled frequency AC power in emergencies when the only source of power in the airplane is a ram air turbine driven pump. The efficiency of this arrangement minimizes the size and weight of the ram air turbine necessary to provide emergency hydraulic and electric power.

Now available in the sizes listed below, larger packages can also be supplied from existing components. Vickers is prepared to develop the package best suited to a specific need. For further information, get in touch with your nearest Vickers Aircraft Application Engineer.

Vickers Airborne Electrical Power Packages	
kva output	weight, pounds
0.5	7.0
1.0	10.5
1.5	12.5
2.0	15
2.5	17
3.0	19

Larger capacities with minimum weight are available.

VICKERS INCORPORATED
DIVISION OF SPERRY RAND CORPORATION

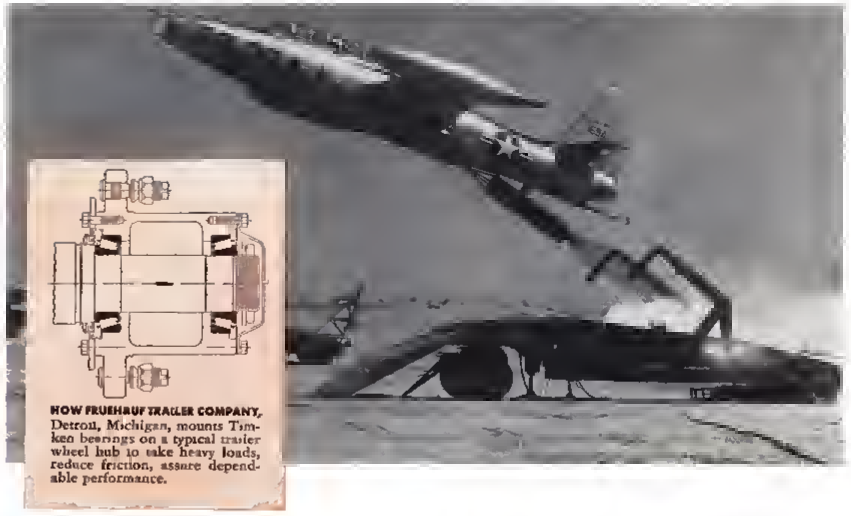
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TELEGRAMS: Vickers WUX Detroit • TELETYPE: "ROY" 1149 CABLE: Videt

OVERSEAS REPRESENTATIVE: The Sperry Gyroscope Co., Ltd. Great West Road, Brentford, Middx., England

Engineers and Builders of Oil Hydraulic Equipment Since 1921



HOW FRUEHAUF TRAILER COMPANY, Detroit, Michigan, mounts Timken bearings on a typical trailer wheel hub to take heavy loads, reduce friction, assure dependable performance.

35,000-pound airport rolls on TIMKEN® bearings

TO make possible launching jet fighters and missiles without runways, Fruehauf built the new "Zero-Length" semitrailer for Martin, Baltimore. And to be sure the wheels and axles could take the 35,000-lb trailer load *plus* the weight of the plane or missile, Fruehauf engineers specified Timken® tapered roller bearings for the wheel mountings.

Timken bearings take *both* radial and thrust loads in any combination. Their tapered construction does it. And full line contact between their rollers and races gives Timken bearings extra load-carrying capacity. The trailer wheels roll easily on Timken bearings. Need no special devices to take the heavy thrust loads of turning.

Wear and maintenance are cut, longer bearing life assured because Timken bearings practically eliminate friction. They're geometrically designed to have true rolling motion and manufactured with microscopic accuracy to conform to their design. Closures are more effective because Timken bearings hold wheels, hubs and axles concentric. Dirt can't get in, lubricant can't get out. And Timken bearings shrug off the shock encountered pulling the trailer over rugged terrain because their rollers and races are case-carburized to give them a hard, wear-resistant surface over a tough, shock-resistant core. The fine alloy steel used in Timken bearings is made in our own mill. We're America's only bearing manufacturer that takes this extra step to insure bearing quality.

No other bearing gives you all the advantages that Timken bearings give you. Specify them for the machines you design, buy or build. Always look for the No. 1 sign of value on every bearing—the trademark "Timken". The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

This symbol on a product means its bearings are the best



WE MAKE OUR OWN STEEL

The special grade alloy steel which gives Timken bearings their strength and resistance to wear is made in our own steel mills.

Only Timken tapered roller bearings have these advantages: 1 advanced design, 2 precision manufacture, 3 rigid quality control, 4 Timkeo fine alloy steels.

TIMKEN
TRADE-MARK REG. U.S. PAT. OFF.
TAPERED ROLLER BEARINGS



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When Aircraft Engines Need Protection Most...

Take-off — the time when throttles are firewalled — when engine heat's near hottest. That's when aircraft oil must prove its dependability. *An engine's performance is only as reliable as the oil that lubricates it.* Today, 45% of the oil used by major scheduled airlines in the U. S. is supplied by Sinclair. There is no better proof of dependability.

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Sinclair Refining Company, Aviation Sales, 600 Fifth Avenue, New York 20, N. Y.



THE BOEING B-52 STRATOFORTRESS, America's first jet intercontinental bomber, uses Fenwal Fire and Over-Heat Detectors, located in its eight engine pods. Set at 450°F, 675°F and 750°F, all with a tolerance of ±25°F, these Fenwal Fire and Over-Heat Detectors function the instant surrounding air temperature reaches the alarm point — no lag, no false alarms.

FENWAL FIRE AND OVER-HEAT DETECTORS PROTECT EVERY TYPE OF AIRCRAFT

Fenwal Fire and Over-Heat Detectors are used in every type and size of plane, in every location where fire or excessive heat must be constantly guarded against and instantly indicated. These locations include main engine areas, auxiliary sections, cargo compartments, cabin heaters and inside wing areas.

Fenwal's unit system offers the advantage that electrical isolation of an individual Detector does not affect the functioning of the remaining units. Any Detector may be quickly removed and replaced without disturbing or removing the whole fire detection installation.

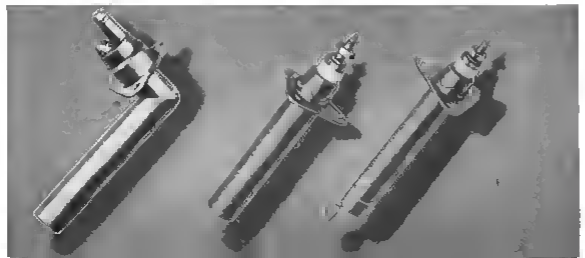
Fenwal Fire and Over-Heat Detectors are made for single-wire and double-wire loop circuits. A loop circuit enables each Detector to act independently in the event of accidental breakage in the electrical conductor. One push-button checks continuity of wiring in either type of circuit.



THE NORTH AMERICAN F-100C SUPER SABRE, first jet fighter to establish a world record for supersonic speed, depends on Fenwal Fire and Over-Heat Detectors for positive protection. Installed around the engine and fuselage, these units give warning *before* dangerous over-heating occurs. Fenwal Thermocouples are also used for temperature indication in the F-100C's J-57 jet engine.

Fenwal

Controls Temperature . . . *Precisely*



THE SHELL IS THE TEMPERATURE-SENSITIVE ELEMENT in all Fenwal Fire and Over-Heat Detectors, giving positive, unfailingly accurate response. Compact and easily installed, these units are available in a wide range of designs, covering different temperature ranges and complying with all applicable military and government specifications. For complete facts write to *Fenwal Incorporated* • Aviation Products Division, 1218 Pleasant Street, Ashland Mass.



Dallas Airmotive Salutes the NBAA

Dallas Airmotive is pleased to salute the National Business Aircraft Association on the occasion of its Ninth Annual Forum to be held in Miami October 23-25. As the engine overhaul agency for many members of the NBAA, Dallas Airmotive is proud to be a member of this progressive and outstanding organization.

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AVIATION WEEK

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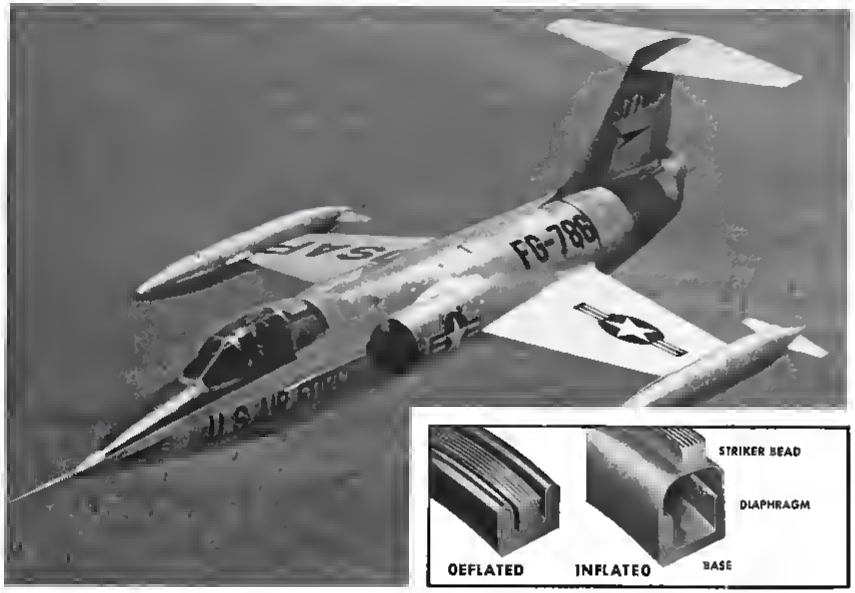
COVER. New float plane version of Helio Courier business aircraft exhibits its short takeoff and steep climb characteristics. With Edo model 249-2870 floats it takes off at full gross weight of 3 000 lb. in zero wind from smooth water in less than 350 ft. lands in the same distance. Rate of climb is 1,130 fpm. Courier seaplane cruises at 140 mph at 8 000 ft. altitude on 69% power of its 260-hp. Lycoming. U. S. Army has become interested in the Courier's STOL performance and awarded University of Wichita a $43,000 contract to evaluate the plane (p. 27).

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New canopy seal protects F-104 from high altitude blowouts

FLYING on revolutionary knife-sharp wings, the Lockheed F-104 Starfighter is the fastest operational combat plane in the air today. Although actual top speed has not been disclosed, its speed in climb is reported to be equal to its speed in level flight.

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EDITORIAL

Passenger Service Pays Off

We have never been slow to criticize the airlines for their deficiencies when they persist in an irritating manner of failing to keep passengers properly informed on the inevitable flight delays caused by weather or technical troubles. Nor are we loathe to cite an outstanding job of handling passengers in this vexing type of situation. We are detailing this particular incident because we experienced it personally, and it illustrates the other side of the story we have told on how some airlines let their passengers stew in ignorance and discomfort under similar circumstances.

Pan American World Airways Flight 115—The President—was about 30 minutes out of Paris on Sept. 27 bound for Keflavik when two sparkplugs in a Pratt & Whitney Wasp Major engine on the Boeing Stratocruiser short-circuited, causing a scored valve. This trouble was quickly picked up by the Sperry engine analyzer. The number one engine was shut down and the propeller smoothly feathered.

Almost immediately, a stewardess spoke over the public address system informing passengers of the feathering, giving an estimated time of arrival back in Paris and promising to keep us informed on further developments. This is a promise often made by airlines but not so often kept. However, before we were in the landing pattern for Orly, the stewardess was back on the microphone with another situation report. There was a spare Stratocruiser at Frankfurt whose crew was being alerted to bring it into Paris. However, it would be at least three to four hours before it could reach Orly. In the meantime, it was evident that at least a three-or-four hour job of maintenance would be necessary on the number one engine. Pan American would get us out on one Stratocruiser or the other, whichever was ready first. Meanwhile, the machinery was in motion to organize dinner for the passengers at Orly.

Evening in Montmartre

On landing, a trio of passenger service representatives were ready to usher us back through French immigration and into the dining room. During dinner we got word that the delay would stretch to seven hours, we were definitely going out on the spare plane from Frankfurt, and an evening in Montmartre was being organized to while away the time. Cable blanks were distributed for messages to alert anybody who had planned to meet the scheduled 8:15 a.m. arrival at Idlewild.

After a good dinner, during which the PanAm service representatives bustled around taking care of all the passengers' individual problems caused by the delay, we all piled into a bus and drove through a Paris by now almost deserted and asleep. Not until we began winding up the Butte Montmartre was there much sign of life. On the hill, the neon signs of the tourist traps blinked and the great white bulk of Sacre Coeur loomed out of a blue velvet night. You could take your choice. Inside were lights, wine and song. Outside was the magic of a Parisian night with the sleeping, sparkling city spreading out below. Under these influences it was hard for anybody to stay disgruntled. A PanAm representative accompanied us and provided hourly bulletins on the situation at Orly. After a few hours, the mood of disappointment and frustration over the aborted flight melted, and the passengers sat down to write a postcard to Juan Trippe, president of PanAm, telling him what a fine time we were having at his expense. Everybody signed it and PanAm even rustled up a stamp for us to mail it.

Dividends for Future

Finally word came from Orly that all was ready. We rolled down off the Butte, piled in the Frankfurt plane, took off for Keflavik again and made a routine flight to New York, arriving seven hours and thirty-five minutes late. In customs, Pan American had a squad of service representatives making airline connections for all passengers who required them. We had been scheduled to be PanAm's 58,581st transatlantic crossing. When we arrived, we were actually the 58,586th, but nobody seemed to mind the delay, and everybody had a kind word to say about the manner in which PanAm treated us. We didn't hear anybody mutter "next time I'll take a boat."

Just to put the incident in its proper perspective, PanAm had 95% on-time arrivals for its transatlantic service during September. During the 24-hour period of our flight, the airline completed 24 flights on various segments of the Atlantic route, of which 17 were exactly on time; four arrived within 10 minutes of schedule; two within 30 minutes, and one was two and one-half hours late. We know that PanAm's passenger service was not always this smooth and that its present efficiency is the result of a long hard effort. But we recommend it strongly as a policy that pays off handsomely. Delivering a Stratocruiser load of satisfied passengers despite a seven hour and 35 minute delay is a real art and a sound investment for future traffic. It may cost a little more money, and it certainly takes more effort to handle passengers with this type of courtesy and consideration but it is bound to pay dividends in the future. —Robert Hotz



FABRICATING A TITANIUM SECTION AT CHANCE VOUGHT AIRCRAFT.

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WHO'S WHERE

In the Front Office

Gen. K. B. Wolfe (USAF, ret.), assistant to the board chairman, Garrett Corp., Los Angeles, Calif. Gen. Wolfe was president of Oerlikon Tool & Arms Corporation of America until his resignation August 15.

George S. Jones and **Alfred W. Kleinbaum** of Wertheim & Co. directors, Gultoo Industries Inc., Metuchen, N. J.

Ostrom Enders, president and director of Hartford National Bank & Trust Co., and **Rodney Dunlap**, vice president-general manager of Torrington's South Bend, Ind., subsidiary directors, Torrington Company, Inc., Torrington, Conn. Mr. Enders succeeds the late Joseph B. Ely and Mr. Dunlap succeeds N. Russell Clarke, retired.

Richard W. Simmons of Blunt Ellis & Simmons a director, Cook Electric Co., Chicago, Ill.

Clifford W. Brown, president, Narmco Resins and Coatings Co., Costa Mesa, Calif.

T. V. Purvis, president, Hupp Aviation Co., Chicago, Ill. Hupp Aviation, formerly Amgears, Inc., is a subsidiary of Hupp Corp.

J. N. Katenhausen, vice president-treasurer, and **David M. Simmons**, secretary and operations administrator, Lockheed Air Terminal, Burbank, Calif.

C. H. "Duke" Butle, vice president-engineering, Sequoia Metalcraft Co., Inc., San Carlos, Calif.

Adm. John H. Cassady (USN, ret.), executive vice president, Flight Safety Foundation, Inc., New York, N. Y., and he will serve on the board of governors and executive committee. Also **Maj. Gen. James McCormack, Jr.** (USAF, ret.), appointed to the board of governors and executive committee.

Honors and Elections

Richard T. Whitcomb, aeronautical research scientist of the NACA Langley Aeronautical Laboratory, who developed the Area Rule concept for supersonic aircraft, received The National Advisory Committee for Aeronautics' highest award, the Distinguished Service Medal. Mr. Whitcomb is the first person to receive the award since it was established last year.

Welco E. Gasch, chief of preliminary design, Northrop Aircraft Inc., has been installed as chairman of the Los Angeles section of the Institute of the Aeronautical Sciences.

Warren Lee Pierson, board chairman of Trans World Airlines, Inc., was awarded the Commander's Cross of the Order of Merit of the Federal Republic of Germany in recognition of his services to civil aviation in Germany, and in strengthening friendly ties between the United States and the Federal Republic.

Morehead Patterson, president of American Machine and Foundry Company, New York, has been elected chairman of the Nuclear Standards Board of the American Standards Assn.

(Continued on p. 102)

INDUSTRY OBSERVER

► Douglas Aircraft's Long Beach Division is conducting design studies for an aircraft that would reach speeds within the Mach 4 to 5 range where skin temperatures would normally be 1,500F. One possibility under consideration is the use of porous skin and coolant that could reduce skin temperature to between 500 and 1,000F.

► North American Aviation's X-15 high-altitude research plane has a design speed between Mach 6 and Mach 7.

► Sidewinder air-to-air missile being manufactured for the Navy by Philco has a long, cylindrical configuration with four triangular fins positioned behind a blunt nose. Fin cluster at rear of missile consists of four generally rectangular surfaces.

► Navy's Triton missile developed by Johns Hopkins University's Applied Physics Laboratory has a design speed just under Mach 2.5. Diameter is slightly less than 5 ft. Length is about 45 ft.; weight between 19,000 and 20,000 lb.

► Stretch press with 600-ton capacity, or about twice the size of any now in existence, is being manufactured for Douglas Aircraft Co. by T. W. and C. B. Sheridan Co.'s West Coast Division. The machine is scheduled to go into operation early next year at Douglas' Long Beach, Calif., plant.

► Helicopter flight simulator connected with electronic analog computer will be built by the Servo Electronics Section of Bell Aircraft Corp.'s Helicopter Division to evaluate cockpit display designs. Pilot will receive ground point reference from cockpit-mounted television screen. Computer will receive control impulses induced by the pilot, compute the dislocation such manipulation would cause in an actual helicopter in relation to ground coordinates and correct the picture on the television screen accordingly.

► Lockheed F-104A Starfighter is undergoing climatic and environmental tests at Eglin AFB, Fla.

► Harvey Aluminum Co., Torrance, Calif., is studying design of relatively-low-cost target and test missile with a speed of approximately Mach 1.5. Design concept anticipates extensive use of extrusions to reduce cost and speed production. Two versions—one with a solid propellant, the other with liquid—are under consideration.

► Light fighters proposed by Spain's Hispano Aviacion S. A. and Construcciones Aeronauticas S. A. have been officially designated the XC-6 and XC-7 respectively. The tricycle-ruled XC-6, a delta-wing aircraft designed by Dr. Willi E. Messerschmitt has the factory designation of HA-300 (AW July 16, p. 23). XC-7, also a delta-wing, has the factory designation of CH-101.

► Douglas has started service deliveries of its A4D Skyhawk, smallest and lightest U. S. jet combat plane. First of the aircraft, which recently completed its fleet introduction program well ahead of schedule, was delivered to the Marine Corps Air Station at El Toro, Calif.

► Vertol Aircraft Corp. has crew of 20 men working on maintenance of Army H-21 helicopters at Ft. Belvoir, Va., under 558,911 contract awarded to Vertol for "troop training" purposes. Army may turn to this method to provide still more maintenance for its aircraft.

► Lightweight gun designed by Armalite Division of Fairchild has been tested by Army's 101st Airborne Division at Ft. Campbell, Ky. Top-echelon officers were favorably impressed.

► First batch of CF-105 all-weather fighters produced by Avro Aircraft of Canada will be equipped with Pratt & Whitney J75 engines, rather than the P&W J57. It is planned to convert to the Orenda Iroquois engine later, probably around middle 1958. The Iroquois is expected to have a thrust considerably higher than 20,000 lb. in its later development stages.



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Washington Roundup

International Relations

Airline and government representatives have been invited to Washington in mid-November to discuss international relations problems in civil aviation. The airlines view the meeting as a needed opportunity to take a fresh look at the Bermuda bilateral principles and other air-carrier problems. The Bermuda approach to international airline economic relations has dominated the scene for 10 years, and the carriers feel that while they are happy with the overall application of the Bermuda principles, there are some details that could stand overhauling.

U. S. relations with foreign carriers have been under heavy fire for over a year. American carriers raised a storm of protest over the rights granted Lufthansa German Airlines 18 months ago, and since then the Dutch have expressed bitter dissatisfaction over their failure to expand operating rights for KLM in this country (AW Oct. 1, p. 25).

In turn, American carriers have had their troubles with India, France and other countries, primarily over flight frequencies and fifth freedom rights.

Now, government and industry representatives will meet next month to discuss U. S. relations with other nations and their airlines. Aircraft manufacturers also will be represented at the conference, and their overseas market prospects will be discussed.

Latin Conference

Lockheed Aircraft Corp. may participate in the Aircraft Industries Assn.'s Latin American Aviation Conference at Miami in mid-November despite an earlier decision not to attend (AW Sept. 3, p. 30). The company is reconsidering its stand in view of U. S. government support of the program. However, Douglas Aircraft Co., which also rejected the initial invitation, still plans to stay away. Douglas feels that its Latin-American sales program is adequate.

Electronics' Unification

A new Defense Department instruction (4240.1) strengthens the position of the Electronic Production Resources Agency and formalizes practice of having a "program manager" in one of the three services primarily responsible for maintaining an adequate production base for a particular electronic component.

The Electronic Production Resources Agency was set up during the Korean war to compile data on the electronics industry, with emphasis upon expanding production capacity without duplication. The new plan is designed to bring more unification into the electronics program of the three services and to eliminate fuzzy areas and differences of opinion.

New Tool Program

The Defense Department is seeking a streamlined, uniform program for efficient, economical replacement of government-owned, in-use machine tools.

The services have until late November to provide Assistant Secretary of Defense for Supply and Logistics with sound, detailed replacement programs that will allow him to conduct studies leading to an overall program.

Problem is that only a few of the 21 separate agencies and bureaus concerned with machine tool use now have sound programs. New Defense Directive (4215.2) orders that agencies that do not have them must get them, that Fiscal 1958 budget estimates provide funds for replacement of tools specifically labeled as such, that funds so earmarked be used for nothing else without approval, and that estimates for replacement range between 2 and 5% of the acquisition cost of machine tools listed in the defense inventory.

The directive does not extend to reserve tools and probably will not change existing programs, such as the one the Air Force has had in effect for approximately one year, if the Defense Department considers them sound.

Defense Oppases Rail Baast

The Defense Department is contesting the proposal of six eastern railroads to increase their first-class passenger fares by 45%—a boost that would likely divert substantial business to the airlines.

In a presentation to the Interstate Commerce Commission, Col. Ray J. Cox, chief of the Army's Passenger Traffic Division, protested that the rail proposal would not only greatly increase the military services' transportation bill, but would also lead to the retirement of passenger cars and leave an inadequate rail lift potential to meet an emergency. In 1955, the Defense Department spent over $37 million on first-class rail travel.

"The diversion of first class rail traffic to other modes will result in the curtailment of such service," Cox stated. "It is inconceivable to the military departments that the proposed rail rates, which in certain cases exceed the commercial air fares by more than 50%, will not divert traffic to other modes of transportation."

Cox noted that although only six lines are requesting the rate increases these will alter joint fares and "spread the effect throughout the nation."

New Flight Check for Airways

The Civil Aeronautics Administration has adopted a new air navigation checking system which, tied in with an electronic airborne computer, permits flight checking of the airways every 30 days instead of the 120 days required under the present method. The new system divides the entire country by east-west and north-south grid lines 100 miles apart. By flying the grid lines and recording signals on tape through the airborne computers, check planes can cover a series of facilities on a single flight. Previously, they had been forced to orbit around an individual station. The CAA Aeronautical Center at Oklahoma City will analyze the tape for any inaccuracies detected by the computer.

$100 Billion Investment

The U. S. had $100 billion invested in the military and civil aviation industry by the end of last year and will have a $150 billion investment by 1960. Secretary of Commerce Sinclair Weeks reported last week. Weeks, speaking at the annual meeting of the National Association of State Aviation Officials, estimated that U. S. airlines have more than $2 billion worth of piston, turboprop and turbojet transports on order and said that when jet transports now on order go into service in 1959, they will be "only the first members of a whole new family of aircraft."

—Washington staff

Army Strengthens Its Aviation Program

Primary role goes to expanding TRADCOM; direct contracts to cut out USAF, Navy middlemen.

By Claude Witze

Washington—U. S. Army last week reorganized and strengthened its management of aviation research and development projects.

These new policies, which constitute a major effort to more fully divorce Army aircraft procurement from USAF and Navy middlemen, have been put into effect:

- Army intends to perform its own research and development contracting independent of the other armed forces, so long as the projects have their major applications in the Army and will not involve duplication of programs or facilities.
- Army aircraft of types that have a major civilian application must be designed to civil standards and be capable of certification by the Civil Aeronautics Administration. Military specifications will be imposed on top of the civil requirements. The Army says it will purchase these "off-the-shelf" aircraft in the "quickest and cheapest way." Presumably, when the Army desires, this will include direct purchase, without USAF or Navy intermediaries.

R&D Responsibility Shifted

Basic to this program was the transfer on Oct. 1 of basic research and development responsibility from the office of the Chief of Transportation to the Transportation Research and Development Command (TRADCOM) at Ft. Eustis, Va.

In turn, TRADCOM's Army Aviation Division has been authorized to add 45 new civilian and military personnel to its present staff of about 60 persons.

Predominantly, these new employes will be aeronautical and mechanical engineers. Maj. Gen. S. R. Browning, deputy chief of transportation, says the Army will fill the jobs slowly as the strengthened TRADCOM division expands.

Aviation Systems Branch

At the upper level, major changes include an expansion in the office of Col. W. N. Redling. Transportation Corps executive for research and development. Redling now has two assistants, one for aviation and one for surface programs. Added to his staff are four aeronautical engineers.

Col. Redling pointed out that this change probably is long overdue since air transportation in today's Army requires ten times the talent and expenditure devoted to surface R & D projects.

In addition, a new Aviation Systems Branch has been added to the office of the Assistant Chief of Transportation for Army Aviation. More or less replacing the Engineering and Development Branch, whose mission has been shifted to TRADCOM, the Systems Branch is responsible for developing and maintaining "line of balance" analysis for each aircraft system.

Transportation Corps spokesmen point out there is only a slight similarity between the Systems Branch Office and USAF's Weapon System Project Office. For one thing, the new Army unit, while responsible for making sure that component development is properly phased, evidently has no power to make decisions or to take corrective action when it uncovers bottlenecks.

Its function, as described by Maj. Gen. Paul F. Yount, Chief of Transportation, is to provide recommendations as to actions necessary to maintain the systems in balance or for changes in the aviation plan necessitated by deficiencies in the line of balance elements."

Chain of Command

Essentially, the Systems Branch is a coordination office" at headquarters created along with the expansion of TRADCOM's research and development responsibilities. For the most part, a project coordinator in this office will monitor his program through TRADCOM's research and development project engineer, the plans and programs project officer from the Transportation Supply and Maintenance Command at St. Louis, Mo., and the training project officers of the Transportation Training Command.

The Systems Branch, when fully organized, will have sections for categories of aircraft—cargo helicopters, observation, etc.

Gen. Browning says this program will be limited in the early stages, expanding as new personnel are added to the TRADCOM organization.

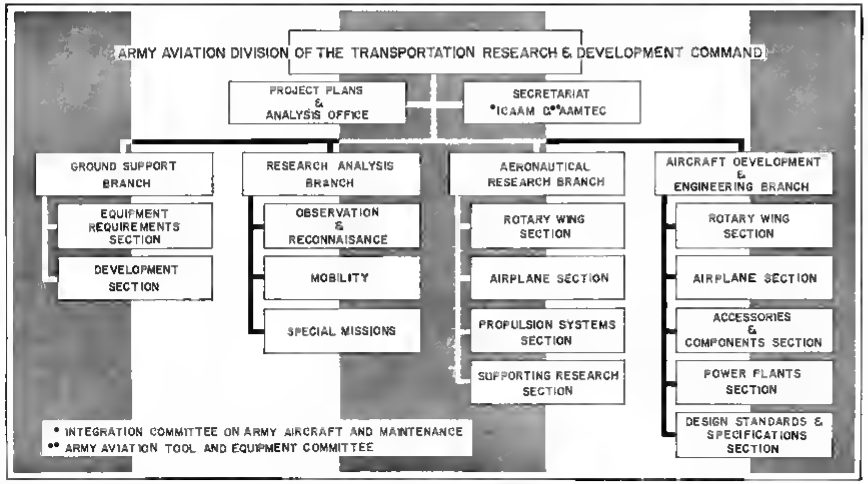
Close study of the program brings out these other trends and possibilities:

- **Army will increase the number of direct study contracts given to industry.** Because of the nature of Army Aviation, small firms, rather than large ones, can expect a major part of the business. These contracts will not involve production of hardware, they will be for paper and slide rule work.
- **Contracts for test aircraft or "flying test beds"** are now being placed directly by the Army and through the Office of Naval Research. This policy will continue but the Army can be expected to place its own contracts directly when the project has applicability only to the Army mission.
- **Procurement of end-item** aircraft for use in the field will remain in the hands of USAF and the Navy only when the end item has purely military application.
- **Army's decision to insist on CAA** basic standards in aircraft with important civil application is a policy that will have major impact upon the helicopter industry.

USAF procurement officials are opposed to this procedure, and it is no secret that their insistence on military specifications alone has been a source of clashes with the Army. Failure to meet CAA standards particularly in transport helicopter design, has curbed the production base, increased costs, interfered with maximum flight experience efforts and hampered civilian airlines in their ambitions to operate helicopter feeder services.

The Air Transport Assn., placing the blame upon helicopter manufacturers, has emphasized the seriousness of this situation (AW Sept. 3, p. 38). In addition, Army spokesmen point out that their own military capability will be greatly bolstered if the civilian helicopter fleet can be built up with aircraft easily converted to the Army mission.

Requirements peculiar to Army aircraft specifications, which must be added to CAA demands, include such items as complete protection of the engine with filtered air, dust boots over sealed bearings, complete parts interchangeability, quick change kits for the field, design to standard ground support equipment and ease of maintenance.



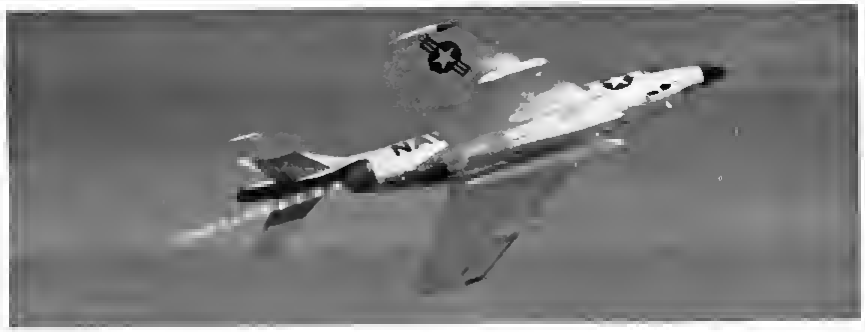
Helio Test Contract

Ft. Eustis, Va.—Army's Transportation Research and Development Command (TRADCOM) has awarded a $43,000 contract to the Municipal University of Wichita to flight test the Helio Courier airplane.

TRADCOM spokesmen told Aviation Week the Wichita contract is one of several that will be given to universities. Discussions are under way with other schools, and TRADCOM is looking for more university talent for similar projects.

Army engineering and performance testing traditionally is carried out by the USAF at Edwards AFB, Calif., and by the Navy at Patuxent River, Md. In addition to the strain on these facilities, which sometimes hampers Army programs, TRADCOM feels that universities may be more proficient in certain areas.

The Helio Courier is an aircraft with STOL characteristics. Designed by Prof. Otto Koppen at the Massachusetts Institute of Technology, it is manufactured by Mid States Engineering Co., Pittsburgh, Kan. Wichita will evaluate its performance, stability and control.



Demon Shock Waves

Afterburner light-off of F3H-2N McDonnell Demon produces shockwaves in air heated to incandescence. Demon is powered by Allison J71 engines, carries two external fuel tanks and four interceptor rocket packages.

RCA Receives Contract For CF-105 Electronics

Washington—The Radio Corp. of America has been awarded a multi-million dollar contract for research and development on an integrated electronic weapons system for Canada's CF-105 jet combat plane manufactured by Avro Aircraft Ltd. Minneapolis-Honeywell Regulator Co. will participate in the RCA project.

The contract was awarded by the USAF on behalf of the Canadian Department of Defense.

Telescopic Tracker Has 300 mi. Range

Washington—An Army Signal Corps ton-and-a-half telescopic tracker, capable of tracing a missile 300 miles away, is undergoing test at White Sands Proving Grounds, N. M.

The tracker has a 160-in. lens weighing 400 lbs. In advance tests at Fort Monmouth, N. J., it successfully measured flights of weather balloons, checked the accuracy of radar by tracking a target, and gauged the fall of parachutes.

The tracker may be located in danger areas and by remote control, transmit records of the impact of rockets and other missiles.

Maintenance Crisis Threatens Mushrooming Army Aviation

By A Staff Correspondent

St. Louis—Army aviation, fastest growing arm of the U S ground forces, has outgrown its maintenance capability and faces an almost inevitable crisis before the end of 1960.

Predicting a 200% increase in maintenance requirements over the next four years, the Transportation Supply and Maintenance Command has turned to the aircraft industry for advice and help.

There is a strong possibility that one of the results will be a substantial increase in the amount of overhaul and repair performed under contract. Most of this will be on component assemblies.

Underscoring the urgency of the problem, the command last week summoned approximately 200 Army aviation and contractor representatives to a grinding two-day meeting here to study the problem.

Various industry guests, representing prime and component manufacturers as well as aircraft operators and overhaul contractors, were told frankly that Army's present aircraft maintenance and supply units—created in an organizational structure that dates back only to 1952—are incapable of providing adequate support. The reason is the increasing inventory and complexity of Army aircraft.

The Transportation Supply and Maintenance Command, headed by Brig Gen William B. Bunker, assumes that the number and complexity of aircraft within a field army will continue to grow and that the Army mission will depend more and more upon organic aviation.

It was disclosed that the amount of aircraft maintenance required by a field army has increased three and one half times since the present organization was established in 1952. Much of this maintenance demand has been brought back by helicopters. From the maintenance standpoint, an H-21 helicopter, for example, calls for five times the effort to keep it combat ready as that of an L-19 fixed wing aircraft.

New Maintenance Concept

With low aircraft availability already plaguing its operations, the Transportation Corps has gone to the extreme of considering an entirely new maintenance concept, featuring a component replacement system. This would involve sending a minimum of maintenance personnel and equipment into the field with a fighting unit, but it would increase the amount of stateside rehabilitation of worn components. It follows that the program would remove a vast number of small parts from the supply pipeline, replacing them with bulkier, heavier replacements and quick assembly kits.

The new concept would deny each commander a private aircraft maintenance facility and cut his service down to what can be performed by a crew chief with a screw driver, a pair of pliers and a wipe rag.

Supporting the crew chief, there would be no out-and-out repair facility short of the continental U S, where all sub-assemblies or components would be shipped for rework.

In contrast, the present Army maintenance system provides for taking service to the customer and getting it as near to the front line as possible. The cost in trained personnel, logistic problems, inventory control and procedure problems threatens to become prohibitive.

It was disclosed, for instance, that last year's Exercise Sagebrush—the joint Army-Air Force maneuver held in Louisiana—involved normal flying hours for 386 Army aircraft. On the basis of known maintenance replacement factors, 4,800 line items were shipped to the scene, where in two months only 800 of them were used. Thus is a utilization of 16.5% of the parts shipped.

An additional serious factor is obsolescence, which results in waste of the procurement dollar. The Army buys approximately 3,000 parts for each aircraft. Some 850 of the items are obsolete before they are delivered.

There is some feeling that the component replacement concept of maintenance is the only strong remedy for this situation.

Gen. Bunker made it clear to his conferees here that the Army has not decided just how it will solve the problem. The component replacement concept, he emphasized, is only an idea. Against it, there is a proposal (popular with the military) for a sound shakeup and expansion of the present system. Essential to this is a stern tightening of regulations to bring about firm discipline over maintenance personnel, to make sure that every man does his job.

From the advice solicited and given by manufacturer's representatives, it seemed clear that Army's solution will be some kind of compromise salvaging the best parts of each plan. It was significant that guests at this year's meeting included Petroleum Helicopter, Inc., who fly their own aircraft in South America. Also represented was Hayes Aircraft Corp., of Burmingham, Ala., contract overhaul operator at the Army Aviation Center, Ft. Rucker, Ala.

Army Aviation Growth

In addition to being flattered by Gen. Bunker's sincere plea for professional advice, the aircraft manufacturers noted a sharp contrast between last week's meeting and the previous maintenance symposium conducted in the spring of 1954 (AW May 17, 1954, p. 14).

At that time, the helicopter manufacturers were given a rough reception, told bluntly that their aircraft were too expensive to buy and operate. The emphasis was put on the short life of components and the supply and maintenance command warned that they stood in danger of pricing the Army out of the rotary wing market.

Vast advances have been made toward improved helicopter component life since 1954, and it is evident that the Army is going to depend heavily upon them at least until a satisfactory STOL aircraft is available. It is equally evident, and asserted by some Army aviation officers, that their service has "grown up" in the past two years and come to realize, as the Air Force did years ago, that military talent is limited and industry know-how is invaluable.

Along with this shift in attitude is the greatly increased stature of Gen. Bunker's command in the field of aircraft procurement. His office is spending increasing amounts of Army aviation funds, and in addition, he is responsible for all other Transportation Corps supply contracting. According to Frank W. Higgins, Assistant Secretary of the Army, the supply system today is valued at $20 billion, down from $25 billion four years ago. His aim is to prune more material out of the warehouses and pipelines.

In Gen. Bunker's view, his command's biggest problem is to determine the aviation supply and maintenance concept that will be employed over the next five to ten years, which will see the biggest advances in this field of Army activity.

Manufacturers represented at the two-day meeting included Bell Helicopter, Sikorsky, Vertol, Spartan Aero Repair, Cessna, Beech, Hiller, Parsons Aircraft, Piasecki Aircraft and Lear.

Maintenance Yardstick

St. Louis—U. S. Army measures the amount of work needed to keep an aircraft combat ready in terms of "aircraft maintenance equivalents."

Basis of this work yardstick is the amount of maintenance required by the L-19 fixed wing observation and liaison plane, which has a maintenance equivalent of one assigned to it.

Present authorization for a field army is 913 aircraft, including both helicopters and fixed wing. They represent aircraft maintenance equivalents of 2,828, up from 800 necessary to support fewer than 400 aircraft assigned to a field army in 1952.

For contrast, an Army two-and-one-half ton six-by-six truck has a maintenance equivalent of about 1/4th. This means an L-19 is 10 times as complex to maintain. An H-21 helicopter is 50 times as complex as the truck.

Gavin: Army Needs Planes, Missiles

By Richard Sweeney

Los Angeles—Army thinking today is geared toward getting the weapon systems and equipment the foot soldier needs to fight in the atomic age, Lt. Gen. James M. Gavin, U S Army chief of research and development told the SAE national aeronautic meeting.

According to Gavin, this means:

- More airplanes, logistics and STOL-VTOL types.
- More missiles, which are tailored to the Army's role.
- Weapon systems tailored to do specific jobs.

No longer is it necessary to be able to produce the most destructive nuclear weapon, Gavin pointed out, for it is possible to destroy the world this way. Rather, the Army needs nuclear and other weapon systems with which it can fight peripheral wars, or on battlefields widely dispersed as is planned in nuclear warfare. Weapon systems must be tailored to deliver the right blow at the right time and place.

Gavin told the SAE that while USAF may see manned airplanes giving way to guided missiles, the Army sees only an ever increasing need for airplanes. It will need logistics airplanes to keep its supply pipelines open and flowing. At the using end, STOL-VTOL aircraft will be needed to haul ammunition around widely dispersed battlefields, haul out wounded and maintain communications.

The Army needs, Gavin said, "an airplane designed for the infantryman's dirty war."

Gavin also called for lightening and simplification of Army communications (probably on a level with miniaturization and transistorization such as has taken place in aircraft communications equipment).

The Army wants everything to be as light weight as possible, air transportable from factory to the battlefield soldier, Gavin said.

Stainless Steel Sandwich Used In B-58 Structure, SAE Told

By Irving Stone

Los Angeles—Convair's supersonic B-58 bomber is the first production aircraft to use brazed stainless steel sandwich as primary structure.

While the B-58 makes extensive use of adhesive bonded sandwich incorporating aluminum alloy facings and either aluminum or glass-plastic core, portions of the airframe must operate at temperatures beyond the point where this type of construction is adequate, A. A. Lanzara, design specialist at Convair, told a panel of the national aeronautic meeting of the Society of Automotive Engineers.

Comair required a structure which retained the qualities of a bonded sandwich up to temperatures approaching 900F., and studies established that brazed stainless steel sandwich would meet this requirement, Lanzara declared.

Strength-Weight Ratio

Sandwich material consists of 17-7PH core and facings furnace brazed with 85-18 silver manganese. The sandwich has a comparatively high strength-to-weight ratio in the 600-900F. range. The core provides complete stabilization of the thin facings and effectively eliminates heat sinks and thermal buckling normally associated with high temperatures, affording a smooth aerodynamic surface, Lanzara said.

Tests showed that under extreme conditions of heat, vibration and sound, the sandwich makeup has excellent fatigue characteristics, equal or better than conventional types of construction. These properties, combined with the fact that there was no known alternate available which was comparable in weight, dictated the choice of the brazed stainless panel.

Lanzara revealed that a test panel was flash heated to 1,100F at a rate of about 30 deg. per second. The panel warped visibly during heating, then straightened as it cooled. Tested in axial compression, it failed above 150,000 psi., indicating that the brazed joints had not been affected by elevated temperature.

The 85-18 brazing alloy is not the final answer, because its temperature range is limited, but "we feel it fills our needs quite well for the B-58," Lanzara said. "Many new brazing alloys are currently under investigation for specialized uses in future designs."

Improper cleaning or atmospheric contamination during brazing may prevent a quality joint from forming, hence to insure that a high strength panel is obtained, rigid control and inspection must be maintained throughout the entire process, Lanzara said.

Radiographic inspection offers the most thorough and dependable method of non-destructively inspecting for internal quality. X-ray will reveal unbrazed areas, core defects, evidence of contamination and mismatched parts.

Production Forum

Production problems associated with steel and titanium forgings in high speed flight highlighted the SAE Aircraft Production Forum.

The end user is confronted with excessive machining of bulky forgings, which look about the same as those produced about 25 years ago, according to S. R. Carpenter, producibility supervisor for Convair Division, General Dynamics Corp. "We would feel better if some tangible progress were made toward closer tolerance forgings," he declared.

Carpenter emphasized his point by presenting data associated with Convair's F-102. A study was made of 28 steel forgings, ranging up to 30 lb. in the as-received condition. Total rough forging weight of the group was 383 lb., while total finish machining weight ended up at 87 lb., giving weight of chips equal to 296 lb., for an average reduction of 77% in weight from machining. These figures, he said, are based on so-called close standards. It is apparent, he added, that some progressive effort is needed to establish closer forging standards.

Progress Points

Carpenter listed five points on the "sign posts of progress," tagging these items as a big order which is past due:

- More accurate alignment of forging equipment to reduce mismatch.
- Higher temperature die material to permit increased forging pressures.
- Improved ingot quality to meet demands for larger forgings.
- Development programs aimed toward precision type forgings.
- Alloy developments for better forgeability if present alloys will not permit precision type forgings.

Hinting at future examples in steel and titanium forgings, Carpenter referred to a number of aluminum alloy forgings now in production for the F-102. Two of these are spars one 10 ft. long, the other 13.75 ft. long. A third unit is a large fuselage bulkhead.

With limitations imposed on such aluminum alloy forgings because of

temperature considerations in tomorrow's planes, Carpenter said that large steel and titanium forgings would be required in their place. A completely machined unit such as the 10 ft spar in steel would weigh 200 lb, with the machining generating about 800 lb of chips with today's rough standards for steel forgings, Carpenter declared.

Meanwhile, steel improvements are "on the march," Carpenter said. Rare earth additions have improved forgeability, and vacuum melted steels are in early stages of production to improve quality and properties. Ultra high strength levels are here, but the full potential of these ultra strength steels cannot be realized in a practical manner at the present time because of machining problems.

Convair machining tests of turning and boring with single point carbide tools on the ultra-strength steels (260,000 280,000 psi) show increased costs may be at least 400% greater than 180 000-200 000 psi steels. Ceramic cutting tools have been encouraging from tests of turning and facing operations without interrupted cuts.

Weight Advantages

"We believe carbide machining costs may be reduced 50% by use of ceramic cutters in these operations," Carpenter pointed out, but he added that milling, drilling and tapping of the ultra high strength steels are the greatest stumbling blocks for high scale production at reasonable cost.

Titanium forgings offer substantial weight advantages, in the heat treated condition, over 280 000 psi steels currently in production use, Carpenter claimed. In the annealed condition, titanium shows definite weight advantages in comparison to steels at a strength level of 180,000 psi. Several titanium forgings are in production use at Convair. One is a channel section 44 in. long and 6 in. high, weighing 9 lb. Several other forgings are in the design stage.

At present, there are no existing government or AMS specifications for titanium forgings, and the user must establish his own requirements. Major considerations at Convair are:

- **Forging stock** should be double melted material, using consumable electrodes for each melt.
- **0.1 maximum** carbon content.
- **Mechanical properties,** including 4% minimum transverse elongation.
- **Maximum temperature** forging limitation (1,700F for Ti 4AL-4MN).
- **Annealing** treatment after forging (1,300F 1 hr., air cool for Ti 4AL-4MN).
- **Complete descaling** during forging operations and after final forging.
- **Surface not rougher** than 160 microinches.
- **125 parts per million** maximum hydrogen content after forging.
- **Specimen test,** when size permits, for each forging.

In the light of present and future machining requirements, the important role of precision forgings also was emphasized by W. V. Stackhouse, group leader, design standards, North American Aviation, Inc.

Stackhouse's premise is that a supersonic airframe is required if sustained supersonic speeds are to be obtained. Future airframe components will accent these factors:

- **Complex shapes** will be involved.
- **Considerable carving** will have to be done to remove material or alternatively, production techniques will have to produce the equivalent.
- **High strength** materials will be required capable of withstanding the effects of high temperature generated from sustained high speed flight.

By 1970, thermal-resistant high-strength materials will be used almost 100% and machinability of these materials will be a big problem. Indicative of this trouble is the comparison of the 1,500 surface fpm cutting speed for aluminum alloy as against 250 surface fpm for stainless steel (a speed attained for cutting aluminum alloys back in the early 1930s). Approaching 1970 the yearly average production will drop about 75% unless these slow machining methods can be overcome.

As an answer to these difficulties, the high precision forging presents a golden opportunity, Stackhouse stressed.

No-draft precision forgings can drop costs considerably, and even though die costs, etc., are high, a savings can be realized in the end. This does not apply to simple parts easy to machine.

Utilization of steel forgings have climbed in successive aircraft. In the F-86E, 175 lb. of steel forgings were used, while in the F-100D, 1,313 lb. of these forgings have been employed. This plane also use 21 lb. of titanium alloy forgings.

Stackhouse indicated the machining load on the F-100 by revealing that there were 1,297 machined parts in the F-100A as against 2,017 in the F-100D.

Forging requirements as related to future missiles were outlined by L. M. Christensen, forging design engineer, Northrop Aircraft, Inc.

Key considerations mentioned:

- **Progressively greater** high strength materials will be required because of high loads and temperature.
- **Quality and reliability** of material will be of great importance. Inspection methods not yet devised probably will be necessary.
- **Elimination of machining** by forging to precise tolerances will become the regular procedure. This will be necessitated by the huge quantity of units which may be involved in a missile program and by the demand for most effective strength levels. These levels of strength cannot be achieved when forged grain fiber is machined away.

Precision Forgings

Christensen pointed out there would be great problems involved in producing precision forgings in the heat resistant alloys, but that these difficulties would have to be surmounted. New types of equipment may have to be developed for achieving precise forging with an alloy that is very difficult to forge. He pointed out that it is not beyond the realm of possibility that explosive forming may be the answer.

Configurations will vary from small fittings for air-to-air missiles to huge structural fittings on the intercontinental ballistic missile. Weights can be expected to range from a fraction of a pound to several hundred pounds. Using the Northrop SM-62 Snark as an illustration, Christensen said that this missile has two steel members which weigh 197 lb., each as rough forgings.

Some forge shop viewpoints were detailed by J. F. Nelson, chief metallurgist, Kropp Forge Co.

The designer, he said, should state what he needs in a metal good strength-to-weight ratios, high modulus of elasticity, excellent stress-rupture and creep characteristics, good fatigue, low notch sensitivity, and still be workable through many phases of production operation. This of course, is an ideal metal, but is probably not too far out of reach today, Nelson said.

Emphasis must be placed on much-needed alloys, as has been done in the jet engine industry, where nearly every month some new high temperature alloy seems to be required as a forging.

A very common configuration, yet quite difficult, presented to the forge shop by the airframe designer is the apparently simple channel section, Nelson declared. With alloys capable of developing higher strengths, the webs and ribs of these channel sections become thinner and lighter. When the ratio of rib height to rib thickness exceeds four to one, the problem of filling the die increases considerably.

Douglas STOL-VTOL

Army is very interested in Douglas STOL-VTOL design, which is an outgrowth of studies which started years ago on a replacement for the DC-3. Douglas has stayed interested in STOL-VTOL plane after studying and abandoning helicopters. The project is not yet firmed up as a military commitment, and may very soon become a commercial venture in another version.

Two New High-Altitude Rockets Developed for Defense, NACA

Two new portable and inexpensive upper-air-research rockets have been developed for Department of Defense and the National Advisory Committee for Aeronautics.

- **Terrapin,** developed by the University of Maryland and Republic Aviation Corp.'s Guided Missiles Division for Department of Defense, is a two stage, solid propellant rocket less than 15 ft. long and weighing 224 lb. Thickest diameter is 6½ in.

The Terrapin attained Mach 5.8 on its first flight from a collapsible zero-length launcher at the National Advisory Committee for Aeronautics proving ground at Wallops Island, Va., and reached a height of 80 mi. Republic has completed preliminary design of a third-stage rocket designed to send the Terrapin to 200 mi.

- **Nike-Cajun,** developed by NACA, is powered by two solid propellant rocket motors that will carry a 40 lb. nose cone to 100 mi. at a speed above Mach 6. More than 100 Nike-Cajuns will be fired during the International Geophysical Year. The rocket was converted from a hypersonic research vehicle.

NACA Firsts

The NACA said it has used rockets with as many as four stages to propel research models more than one million feet (approximately 200 mi.) above the Atlantic Ocean from its remote Wallops Island station at speeds up to 7,000 mph.

This apparently means that NACA was the first to fire hypersonic test vehicles, the first to reach such high speeds with rockets, and the first to reach that altitude except for the Bumper project.

NACA has been testing the Nike Cajun successfully for several months with instruments in the nose cone.

Nike-Cajun Tests

A small sphere which would be ejected from the nose cone near the peak of Nike-Cajun's flight to measure air density has been developed by Michigan University's Aeronautical Engineering Department and the Geophysics Research Directorate of the USAF Air Research and Development Command's Cambridge Research Center.

The rocket consists of a Nike booster motor and the NACA sponsored Cajun high performance motor.

The U. S. Weather Bureau and the Office of Naval Research, assisted by Naval Research Laboratory and the New Mexico College of Agricultural and Mechanical Arts, are developing an apparatus for photographing and measuring hurricanes from the nose of the NACA rocket.

Tests of the apparatus already have been made at Wallops Island.

Terrapin Tests

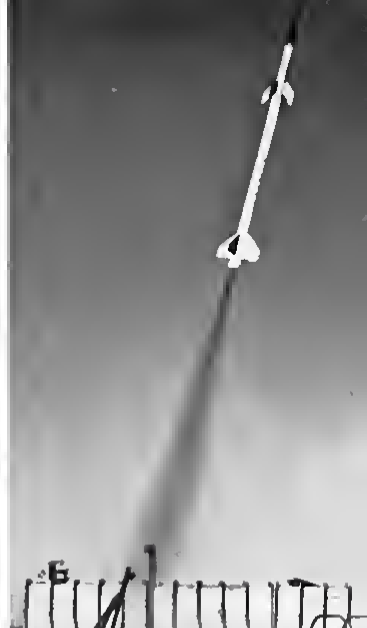
First stage rocket motor for the Terrapin was designed by Allegheny Ballistics Laboratory in conjunction with Navy's Bureau of Ordnance.

Second stage was designed by Thiokol Corp. and Redstone Division of Army Ordnance.

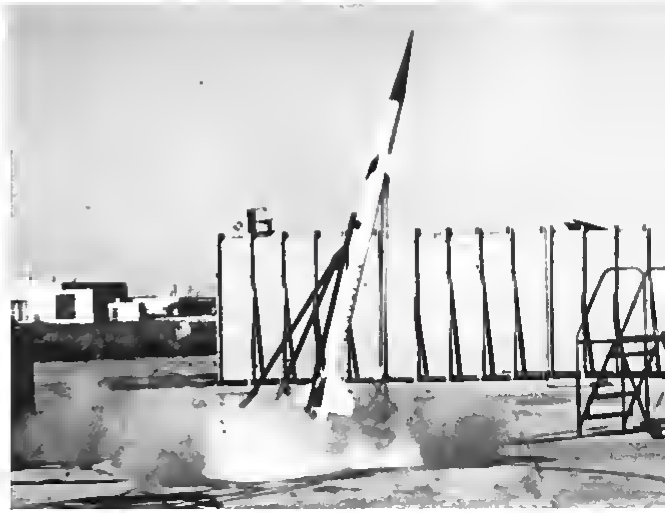
In its first flight Terrapin measured primary cosmic radiation temperatures, spin of the rocket and acceleration forces on the instruments.

Instruments weigh only six pounds. They were specially miniaturized at Maryland. Instruments use printed circuits and include an all-transistorized telemetering system, a transmitter of new design and a Geiger counter. Instrumentation of the rocket was built and assembled by high school and university students.

Terrapin's first stage carried it to 10,000 ft. in six seconds at 1,900 mph. before separating. Second stage coasted to 30 000 ft. before the second stage motor shot the rocket to 50 000 ft. at a maximum velocity of 3 800 mph. At maximum speed, the rocket experienced temperatures higher than 1,000F.



TERRAPIN blasts off (below), starts acceleration (top) to 1,900 mph. at 10,000 ft.



X-2's Loss Leaves Research Gap; Burden May Shift to X-1B, X-1E

By Evert Clark

Washington—Loss of the Bell X-2 rocket plane (AW Oct. 1, p. 34) leaves a gap in supersonic flight research that no existing aircraft can completely fill. Most of the burden, however, probably will fall upon the rocket-powered Bell X-1B and X-1E.

The X-2 was a key research tool in a series of investigations begun 10 years ago by industry, the armed services and the National Advisory Committee for Aeronautics when the first Bell X-1 was built to explore the region of transonic flight.

The X-2 already had yielded invaluable data on aircraft and equipment performance at extreme speeds and altitudes, setting unofficial world records of 1,900 mph. and 126,000 ft. and giving Air Force pilots operating experience that no other plane could provide.

The Crash

But the X-2 was built for two primary purposes—to determine performance at speeds and altitudes unreached before and to explore aerodynamic heating problems at these speeds and altitudes. Roughly speaking, it had completed only half its mission.

Cause of the destruction of the X-2 at Edwards Air Force Base, Calif., on Sept. 27 and the death of its pilot, USAF Capt. Milburn G. Apt, may prove to be a mystery that Air Force will never solve. However, this much is known:

Capt. Apt, 32, was making his first powered flight in the X-2 to qualify as a rocket test pilot for future work. He made a successful drop from the B-50 mother ship at an altitude the Air Force describes as "not excessive" and completed a powered run. He reported the burnout of his fuel by radio.

At that moment, neither the mother ship nor the jet chase plane had the X-2 in sight. From that moment on, ground observers had no further radio contact with Capt. Apt.

A few seconds after burnout, Capt. Apt apparently pushed the button that fired a charge in a central thrust chamber just behind the bulkhead between the pilot's capsule and the main body of the plane.

The force of the exploding charge traveled through four ducts to four mechanical ejection guns which pushed the capsule free of the aircraft.

The capsule fell away and descended, slowed by a ribbon-type drag chute. The sudden shift in the center of gravity of the plane's afterpart caused it to pitch up and peel off.

Capt. Apt's body was found inside the capsule. He had taken all the steps toward survival but the last two—stepping free of the capsule and pulling the ring on his own seat-pack parachute. (The capsule had no ejection seat. The X-2 was designed before such seats were accepted.)

The main body of the X-2 fell intact—indicating that there had been no explosion—and broke into three main pieces when it struck the ground.

Thus far, there are only guesses as to why Capt. Apt did not leave the capsule—nausea or unconsciousness caused by the tumbling of the capsule, etc.

The Air Force had almost completed its work with the X-2. Within weeks, the plane was to have been turned over to NACA's High-Speed Flight Station at Edwards for extensive studies of aerodynamic heat generation and input, boundary layer flow and stability and control. In all these studies, emphasis was to be placed on high speeds and high altitudes.

Although some of the instrumentation necessary to give NACA its data was built into the X-2 at the beginning, no attempt was made during the Air Force phase of testing to gather the kind of detailed, controlled information NACA needs to shape the development of future aircraft and materials.

The NACA had planned to modify and add to instrumentation but did not plan to modify the aircraft or its throttleable, double-barreled Curtiss-Wright XLR-25 rocket engine.

NACA pilots were to have flown both the X-2 and the mother ship, and the USAF was to have provided chase planes.

The relatively-thin, stainless steel wings and tail of the X-2 and its K-monel metal fuselage were especially designed for studying heat problems.

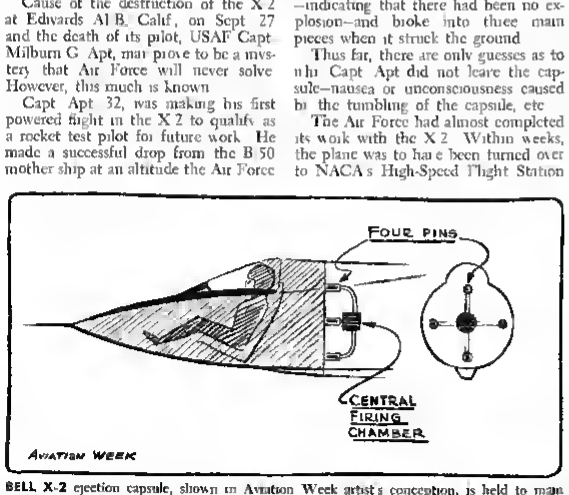
Revised Research Program

There is no plan to build another X-2. The task of filling in the gaps in NACA's store of knowledge apparently will be carried out so far as it can be, by two other research planes in the "X" series:

▪ **Bell X-1B**—Although not as fast or as high-flying as either the X-2 or the X-1E, this plane already has been used for heat studies. Its relatively thicker aluminum skin has been used primarily to give information on the structural effects of heating, rather than generation and input, but it should be capable of performing generation and input studies in the same general regions as the X-2.

▪ **Bell X-1E**—This aircraft differs from other X-1 versions and is expected to fly faster than the X-1A's top speed of Mach 2.5. Wings and tail are only 4% thick, in contrast to the 10% thickness of surfaces on the first X-1s (AW July 23, p. 31). A turbopump drives liquid oxygen and alcohol to the motor. Earlier versions used nitrogen under pressure to feed oxidizer and fuel. Thinner wings and lower weight and volume of turbopump should reduce drag to give X-1E speeds approaching the X-2's performance. For this reason, it may do more of the heat input studies than the X-1B. Best guess is that they will operate as a team.

No manned high-speed, high-altitude research planes are included in "X" numbers between the X-2 and the North American X-15, which is designed for altitude research in the area of 500,000 ft. but is not yet in operation. X-15 design does not include an escape capsule.



BELL X-2 ejection capsule, shown in Aviation Week artist's conception, is held to main section of fuselage at four points. Capsule is ejected by firing a single thrust chamber manifolded to the four pins holding the nose section to place. Capsule has a pilot chute deployed at separation, which drags out main drogue chute. When capsule is at lower altitude, pilot bails out using his own chute.

Pilot Finds Magister Trainer Stable, Safe

By Vico Rossaspina

The Fouga CM-170 Magister is a twin-jet military trainer developing 1760 lb. thrust. Accompanied by Fouga's test pilot, I put the plane through a test program that included a climb to 6,500 meters, stalls and spins, a dive in which I tested the dive brakes, longitudinal and transversal static stability tests, and control effect tests.

Because of the low-slung fuselage the cockpit is easily entered by way of single kick-step in the side of the fuselage. The visibility from the front seat is excellent and the location of the wing gives one the impression of being in a glider.

The visibility from the back seat is also good. A periscope gives an instructor seated in the rear an unobstructed field of vision forward. This feature would be especially valuable during gunnery, bombing and rocket training as well as during ground operations.

The cockpit layout is good. The control stick is of the semi-rigid type which moves longitudinally about a floor-level pivot and laterally about a pivot just below the hand grip. The seat is adjustable vertically and the rudder pedals may be adjusted to suit the length of the pilot's legs.

Takeoff Smooth

Taxiing characteristics are good because of the wide tread of the landing gear. The brakes are effective and smooth in operation.

We used a flap setting of 15 degrees for take-off. I applied power to 22,600 rpm. and released the brakes. The acceleration was noticeable and the takeoff run was smooth and stable. At about 60 knots with zero trim, I used a little back pressure to lift the nose-wheel off the ground. The main wheels lifted off at 90 knots. I believe this easy takeoff is the product of the clean shape of the airplane and its light wing loading.

Flaps and undercarriage must be retracted immediately after takeoff. They are red-lined at a speed of 140 knots which is quickly reached.

I made my climb-out at 220 knots with a rate of climb of 16 meters per second. Every thousand meters of altitude I increased my angle of climb, reducing my air speed by about five knots. I reached 6,000 meters at 190 knots indicated and a rate of climb of 10 meters per second. At 6,500 meters I reduced power and kept the nose up to kill off speed for the stall tests. Because of its cleanliness and high aspect ratio (7.4), the plane continued to climb for 350 meters. During this time we drained the tip tanks to prepare for the spin test.

Unique Recovery

Clean and nose high, the CM-170 buffets increasingly as it approaches the stall. At 75 knots it becomes noisy but is still perfectly controllable. The buffeting in all directions is violent at 70 knots and the nose tends to drop off to the right or the left, but all the controls are still effective. At 65 knots the airplane is still responsive to the ailerons and elevator. At the moment it is completely stalled the CM-170 bounces vertically and the nose drops. When the speed increases to 85 knots the buffeting stops completely. The ailerons remain effective throughout the stall.

To enter a spin, I reduced power and slowed down to about 85 knots, with the stick all the way back, hard rudder into the spin and a light cross-control pressure on the ailerons. It turned completely on its back and then fell off into the spin. After the first turn it began to oscillate with a slight rolling and a pronounced pitching movement. The speed of rotation did not seem to be constant but is a safe spin and an easy one from which to recover.

To begin the recovery I applied a slight back pressure, then put the stick hard-over into the spin and the plane stopped spinning in half a turn. If the stick is pushed forward as in most planes, the CM-170 turns over on its back. If top aileron rather than bottom



SQUAT, widespread legs of Fouga Magister provide good ground control, easy maintenance access. Note perforated speed brakes on wing and instructor's periscope on canopy.

Free Lance Pilot

Vico Rossaspina is a free lance test pilot, a breed that appeared in Europe after World War II because aircraft companies there could not afford full-time flight test staffs. He has recently been released from a tour of duty in the Italian air force and has flown most of the fighter types now in service in the IAF. Rossaspina, 39, has been a glider pilot since 1934, a military pilot since 1936 and an instructor since 1938. He has competed successfully in air races and aerobatic meets, winning the Grand Prix of Marseille and placing third in the Daily Express Air Race at Brighton, England. During World War II Rossaspina was in the Italian air force until the surrender, after which he served as a parachutist for the Office of Strategic Services.

Navy Checks Magister

Washington—Fouga Magister 170, twin-jet French trainer, is making a "presentation tour" of East Coast Navy bases and may be demonstrated to USAF.

The French firm is angling for U. S. orders for the trainer which has been selected by NATO countries. If U. S. services place orders, Fouga would license American manufacturer to produce the Magister in this country. Its Turbomeca Marbore engines are manufactured here by Continental Aviation & Engineering Corp.

This week the Magister will be at Patuxent. Later it will be taken to Pensacola. Last week at Washington National Airport, it made an average of six flights per day with Navy officers as pilot-passengers. The tour is being made at the invitation of the U. S. Navy.

Fouga has not been asked to show the Magister to USAF, although USAF is familiar with it through the NATO evaluation.

The aircraft on tour is an Air Force model. A version with tail hook and landing gear for carrier operations is being evaluated for the French navy.

Fouga CM-170 Magister Specifications

(WITHOUT EXTERNAL STORES)

Max. Level Flight Speed (Sea Level)	423 mph
Best Cruise Speed (30,000 ft.)	296 mph
Max. Range (With Reserve)	570 nm
Max. Rate of Climb (Sea Level)	3,350 fpm
Service Ceiling (R/C 200 fpm.)	40,000 ft.
Takeoff run (over 50 ft. Obstacle)	2,600 ft
Landing Run (5,500 lb.)	1,700 ft
Span	37 ft.
Wing Area	186 sq. ft.
Aspect Ratio	7.4
Length	33 ft
Height	9 ft.
Max. Gross Weight	7,055 lb.
Empty Weight	4,268 lb.
Static Thrust	
(2 Turbomeca Marbore II Centrifugal Flow Turbojets)	880 lb. each
Airfoil	NACA Series 64
Root Thickness	19% M.A.C.
Tip Thickness	12% M.A.C.

aileron is used during the recovery, the spin stops one turn later. It is not even necessary to center the rudders and the elevator. One pilot has made spin recoveries in the CM-170 using hard bottom rudder and keeping the stick all the way back.

After recovering from the spin at about 5,000 meters, I dived to an indicated speed of about 400 knots. At Mach .8 there is a slight upfloat of the ailerons and a slight inversion of the elevators but both effects disappear at Mach .835. To decelerate I used the dive-brakes which are pierced quarter-circular plates located in the wings. They extend smoothly and take effect quickly. There is some vibration but it causes no inconvenience to the pilot. On the prototype airplane the dive-brakes influence the controls but on later models a fence has been installed to prevent brake pressure from spilling onto the ailerons. This has almost eliminated the undesirable effect, and a slight increase in the height of the fence should cause it to disappear completely.

Butterfly Tail

I made one dive with maximum power and noted a slight vibration coming from the engine air inlets which are on the surface of the fuselage. This has since been fixed by separating the air inlet from the fuselage.

Diving speeds are limited to Mach .72 with and without the dive-brakes. With the engine at 21,000 rpm. and the dive-brakes out, the CM-170 comes down from 6,000 meters to 750 meters in one minute and a half, covering a distance of 13 kilometers over the ground.

While diving I studied the controls. I noted good uniformity of control forces and observed no difficulty caused by the butterfly tail. The high aspect ratio fins form an angle of 110 degrees and provide excellent directional stability. The action of the rudder is quite normal at all speeds, in all configurations, and in turbulence. A number of skids and unbalanced turns convinced me of this. The three-position trim tab control on the top of the stick is effective and easy to use.

In landing I made a wide and high approach so that I could study approach characteristics with several flap and dive-brake configurations. I extended the landing gear at 130 knots and decelerated to 100 knots without flaps. The glide angle was very flat and 15 degrees of flap did not affect it much. With 40 degrees of flap, the plane assumed a good nose-down attitude. And precise approach. The landing is easy and nose-high and the efficiency of the wheel brakes allows a rapid stop. The usual run-out is about 250 meters.

In company tests, the CM-170 has made one-engine takeoffs at normal gross weight and cruises on one engine at 5,000 meters. The engines can easily be started in flight. In ground tests at least 60 consecutive starts have been made on battery power only.

Holding Firm of A. V. Roe Issues Stock

Toronto—A. V. Roe Canada Ltd., Toronto, holding company for Avro Aircraft Ltd., Orenda Engines Ltd., Canadian Car & Foundry Ltd., and Canadian Steel Improvement Ltd., is issuing stock for public sale for the first time.

Wood Gundy & Co. Ltd., Toronto, international investment underwriters, are handling the issue of 500,000 shares to sell at about $16 a share with estimated quarterly dividends of 20 cents a share. The issue will represent a little more than 10% of the outstanding common stock of A. V. Roe Canada Ltd.

For the fiscal year ending July 31, 1956 A. V. Roe Canada had a net profit of $8,954,458 as compared with $9,719,538 in 1955. Operating income was $20,810,161 as compared with $24,400,470 in 1955.

There are 7,500,000 common shares authorized and 250,000 preferred shares none of the preferred having been issued. There are 4,237,500 common shares issued. Total assets are shown at $101,331,009.

Avro Aircraft Ltd. makes the CF-100 twin-jet interceptor for the Royal Canadian Air Force and is now starting production on the CF-105 delta-wing supersonic interceptor of the RCAF.

Orenda Engines Ltd. is making jet engines for the CF-100 and Sabre F-86 and a new engine for the CF-105. Canadian Car & Foundry at Montreal and Fort William, Ont., makes railway cars, sub-assemblies for Grumman CS2F submarine reconnaissance aircraft for the Royal Canadian Navy, and heavy industrial steel equipment. Canadian Steel Improvements Ltd., Toronto, makes titanium alloys for jet engines and other steel alloys.

Vulcan Crashes on Instrument Approach

London—Avro Vulcan bomber returning from 26,000 mile flight to Australia and New Zealand crashed during GCA approach at London Airport, killing four crew members. Air Marshal Sir Harry Broadhurst, commander of RAF Bomber Command who was copilot, and Squadron Leader D. R. Howard, pilot, escaped with minor injuries in low level ejection before four jet delta-wing bomber crashed and burst into flames on runway.

The bomber struck a ploughed field several hundred yards short of runway in level attitude, ripping off the bogie under carriage. A spokesman for Avro said. The pilot immediately turned his engines on to full power in an attempt to climb away but at this point, although he gained some height and went back into cloud, he recognized that the aircraft was out of control and within seconds gave the order to abandon ship.

Broadhurst and Howard were the only crew members with ejection seats. Ejection was at an altitude estimated between 200 and 500 ft.

Three Russian Tupolev jets which



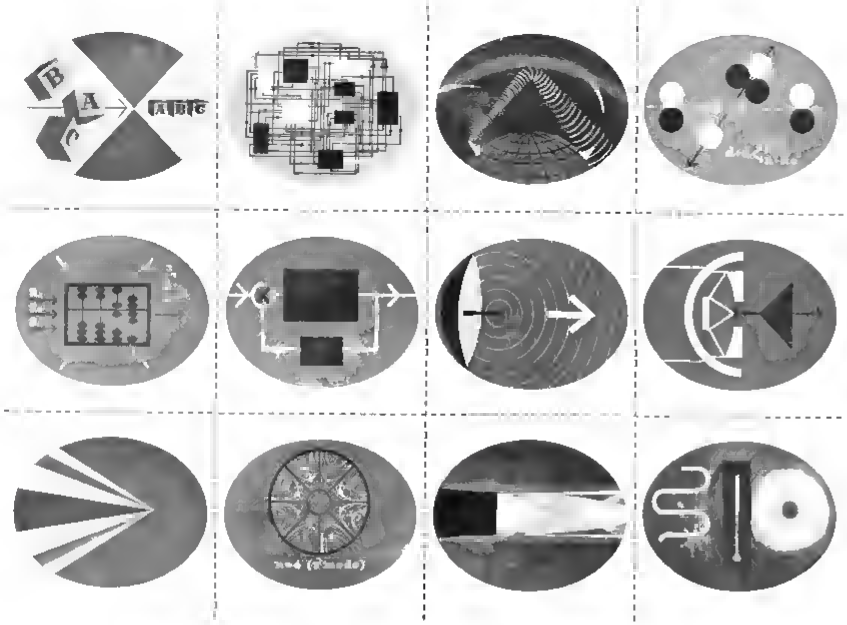
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Variety of Technical Fields

These illustrations are symbolic of some of the scientific and engineering fields of endeavor which are essential ingredients in the broad range of technical programs that are in progress at The Ramo-Wooldridge Corporation. Illustrated are: Information Theory, Systems Analysis, Communications, Nuclear Physics, Electronic Computers, Servomechanisms, Electromagnetic Propagation, Infrared, Aerodynamics, Microwaves, Propulsion, and Thermodynamics.

The requirement for technical competence in a wide variety of fields is a significant characteristic of systems engineering work. At R-W this requirement is particularly important because of our emphasis on the development of systems having a high content of scientific and engineering newness.

Our current military contracts support a number of advanced programs in the fields of modern communications, digital computing and data processing, fire control and navigation systems, instrumentation and test equipment. In the guided missile field, Ramo-Wooldridge has technical direction and systems engineering responsibility for the Air Force Intercontinental and Intermediate Range Ballistic Missiles. Our commercial contracts are in the fields of operations research, automation, and data processing. All of this work is strengthened by a supporting program of basic electronic and aeronautical research.

Scientists and engineers whose training and experience are in these or related fields are invited to explore the openings at The Ramo-Wooldridge Corporation

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were due at approximately same time with members of Bolshoi Ballet were diverted to Manston because of the bad weather. Vulcan was arriving from Aden at conclusion of its first overseas mission and was believed to have been carrying secret documents from recent British atomic tests at Maralinga.

The Vulcan set several unofficial speed records during its Australia flight. The outward trip to Melbourne was made at an average flying speed above 500 mph. Although the Vulcan was not yet in RAF service, the first operational conversion unit was being formed.

News Digest

First helicopter equipped with new Lycoming XT-53 free shaft turbine engine, Kaman Aircraft's Marine HOK-1, was rolled out last week. HOK-1 normally uses a Pratt & Whitney R-1340 piston engine. Copter was modified to accommodate XT-53.

USAF awarded $5.5 million contract to Chino, Calif., division of Pacific Airmotive Corp. for C-47 overhaul. New agreement covers 293 C-47 type aircraft.

Sales for Pacific Airmotive Corp. and subsidiary, Pacair Inc., for nine months ended Aug. 31, 1956 were $14,759,926, compared with adjusted sales of $14,230,118 for same period in 1955. A net profit of $596,174 or $.91 a share was earned for the 9 month period. This compares with an adjusted net loss of $134,168 for same period in 1955.

India signed agreement with Bristol Aero Engines to manufacture under license full range of Orpheus turbojet engines, including Orpheus B of 4,520 lb. and 4,850 lb. thrusts.

A $10-million contract between Flying Tiger Line and Curtiss-Wright Corp. provides for major overhaul of Wright EA-3 turbo compound engines to be used on FTL's new fleet of ten Lockheed Super Constellation air freighters. New overhaul plant will be constructed by C-W in North Hollywood, Calif., to handle project. Constellations will be delivered early next year.

USAF placed a $2.5 million follow-on contract with Beech Aircraft for manufacture of Beech MA-3 jet aircraft ground service units. Initial order was for $5.3 million.

Three-place Bell Model 47H helicopters are being used to give free rides to prospective home buyers from city of Cleveland to suburban real estate development. Stunt was arranged with Cleveland Air Taxi Inc., the city's commercial helicopter charter service.



Sodium Reactor Experiment

Atomic International, a division of North American Aviation Inc., is building a nuclear power plant, the Sodium Reactor Experiment, as part of the Atomic Energy Commission's program to develop economical power from atomic energy. Heat from the reactor, in the background building, will be converted to electricity by generators being installed by the Southern California Edison Co. The plant expected to be in full operation this winter, is located in the Santa Susana Mountains about 30 mi. northwest of Los Angeles.

President Kubitscheck of Brazil will receive two new Vickers Viscount 770-Ds for official flights. Kubitscheck has been using Brazilian air force C-47s for domestic hops and Varig Airlines Super G Constellations and Panair do Brazil Constellations for overseas flights.

Lockheed's Model 1049H passenger cargo Super Constellation rolled off Burbank, Calif., assembly line with markings of Qantas Empire Airways. New series incorporates extra-large door and stronger flooring to facilitate cargo handling. Thawing delivery to Australia is scheduled for Oct. 15.

Boeing Airplane Co. has "firm contracts or letters of intent to purchase" on 134 707 jet Stratoliners according to William M. Allen, president of the company.

William E. Boeing, 74, founder of Boeing Airplane Co., died aboard his yacht in Puget Sound on Sept. 28. Boeing organized Pacific Aero Products Co. in 1916. He remained with the firm until 1934, five years after its name was changed to Boeing Airplane Co. He had no financial interest in the firm at the time of his death.

"Atomichron," called the world's most accurate and stable frequency reference, has gone into use at Rome Air Development Center's experimental Navarho (long-distance navigation) ground station. Produced by the National Corp., the Atomichron makes use of atomic resonance as a reference to hold its frequency accurate to one part in 1 billion.

Naval industrial reserve ordnance plant at Mishawaka, Ind., operated by Bendix Aviation Corp. for production of Navy Talos guided missiles, will be expanded. Secretary of Defense Charles E. Wilson has approved use of $4,400,000 which was in Navy's Fiscal 1957 budget for the project.

Air Force will award Lockheed Aircraft Corp.'s Georgia Division a follow-on contract for more than $100 million worth of C-130 Hercules transports. Number of aircraft was not disclosed.



BOEING 707 in simulated go-round at Seattle-Tacoma International Airport with Acting Administrator James T. Pyle and other top Civil Aeronautics Administration officials aboard. Let-downs and missed approaches also were made under low visibility conditions

Lag in Radar May Delay Airways Plan

CAA team studies jet traffic control; Pyle says technical problems hamper essential plan for airways

By L. L. Doty

Washington—Full implementation of the three-year federal airways plan is essential to "unimpaired" jet transport flights, but at least one phase of the plan may delay complete operation of the projected airways system beyond the 1959 target date.

These were among the conclusions drawn from the first Civil Aeronautics Administration tests of jet transport operations under air traffic control conditions. The flight tests, conducted with the prototype Boeing 707 jet transport at Seattle-Tacoma Airport, give acting CAA Administrator James Pyle and 17 of his aides their first opportunity to evaluate the three-year plan under actual operating conditions.

James T. Pyle

James T. Pyle, acting administrator of the Civil Aeronautics Administration, was named deputy administrator on Mar. 20 and appointed to his present position upon the death of Charles J. Lowen (AW Sept. 10, p. 41).

A graduate of Groton School and Princeton University, he also has completed courses in aviation mechanics, meteorology and air transportation and holds a commercial pilot's license. He has logged more than 4,000 hr. in single and multi-engine aircraft.

Pyle joined Pan American World Airways in 1935 and remained there until entering the Navy in 1944. He served in the Pacific theater as operations officer with Naval Air Transport Service. Following World War II, he was elected president of the Air Charter Co. of Denver and later became president of the Denver Air Terminal Corp. In 1953, he was named special assistant to the Assistant Secretary of the Navy for Air, a post he held until joining the CAA.

Jet Age Musts

Secondary radar is the phase of the program standing in the way of the scheduled implementation of the three-year plan. Pyle admits that several engineering problems block implementation of secondary radar. However, he still believes the 707 tests reaffirm the airways program as it is now blueprinted and foresees no major air traffic-control problems once jet transport operations reach a high density status.

Specific conclusions reached by Pyle and his group during the two-day study:

- **Secondary radar will be necessary** to insure positive control of all high altitude traffic. Pyle considers this indispensable to safe jet operations.
- **Clear-channel distance measuring** equipment will be essential to precision approach and holding patterns.
- **Better communications coverage** and procedures will be required.

Pyle said the radar beacon program (secondary radar) is "almost in the trial stage" and added:

"This is the only questionable item in the program."

Distance measuring capability, he said, will be provided as a part of the Vortac common navigation system (AW Sept. 3, p. 41).

'Slipped' Schedule

The Air Navigation Development Board has admitted that the "radar beacon time schedule has slipped" and full scale implementation of secondary radar by 1959 is "over-optimistic."

Only the New York area will have trial installations of secondary radar in operation by January 1957. Original plans called for service environment tests in five other locations by that date with four New York installations ready by September of this year.

Under the present schedule engineering evaluation of the nine units will begin in early spring and the operational phase of the service environment tests will start next fall.

The Air Navigation Development Board estimates that a minimum of two years will be required to complete implementation after operational trial of the units.

Engineering Delays

Engineering problems which have stalled the program are:

- **Present stage of development** of radar beacons may limit the number of radar stations in certain areas. The main problem lies in the fact that replies to interrogation of one ground radar will be received by all others in the vicinity as interference pulses. In turn, airborne transponders will be interrogated in congested areas by several ground radars which may incapacitate the transponders.
- **De-fruiters that will permit** a final evaluation of secondary radar will not be available for installation until mid-1957.

Positive control of air space is essential at high altitudes because of the high closure rate of the jet transports, Pyle said. He estimated that closure rates will fall within the 1,200 mph. range.

Pyle also called for the end of the "middleman" in the en route airways communications system. He wants direct contact between air-route traffic control centers and pilots at any point at all times. The "area coverage concept," he said, should be adopted so that the system can be expanded beyond the conventional airways pattern to allow a random type of navigational flying.

Jet Traffic Pattern

He said the 707 flight tests "provided us with some positive information about traffic-control requirements" and "confirmed the need for positive control of all high altitude traffic."

He added that he did not anticipate any need for granting priority to jet transports over piston engine aircraft in instrument landings and takeoffs.

Stacking of jets, he said, will be held to altitudes of approximately 20,000 ft. This procedure will be followed for purely economic reasons.

"Lack of economy," he said, "is caused by the pull-up to the 20,000 ft. cruising altitudes from 2,000 ft. (the normal holding pattern) which results in an increase of fuel consumption of 20% for each 5,000 ft. of ascent." He said the ability of the plane to descend rapidly without passenger discomfort should permit controllers to feed it quickly into final approach from a high altitude or off-set holding pattern at airports.

Avoided Missed Approach

Pyle emphasized that landings and takeoffs with the 707 under simulated IFR conditions demonstrated that jet transports can be handled in air traffic control in conventional fashion. During the tests, he said, the pilot deliberately entered the glide path to the right of the centerline but avoided a missed approach by making an S-turn to correct the lateral error.

This and other approach tests suggested that the 707 will experience fewer missed approaches than conventional aircraft.

Pyle said the Boeing transport is controllable at 180 mph. (stalling speed is 116 mph.) so that it can conform to speed limits enforced in the high-density air traffic control zone in Washington.

He said 707 test pilots have expressed a preference for standardization of runway markers showing distances at various stages of the takeoff as a speed check.

White Markings

At the present time, regulations require white stripped markings on the runway surface to indicate landing zones and distances. The Air Force and Navy, however, favor the use of vertical signs along the runway border and have been discussing a standard type of runway marker at Wright Field, Ohio, for the last three months.

Pyle hopes to undertake similar experiments with the Douglas DC-8, Convair 880, Lockheed Electra, de Havilland Comet and other turbine-powered aircraft when they are available.

Meanwhile, the CAA expects delivery in December of five Convair 440s which were ordered from the Air Materiel Command for further high-altitude test flights. At the present time, CAA's inspection fleet consists of DC-3s and Beechcraft C-45s.

High altitude tests in the 20,000-40,000 ft. altitudes will be conducted by the CAA with two B-57s obtained on loan from the Air Force.



CONFERRING before takeoff (left to right) James Gannett, Boeing test pilot; Joseph Tippets, director, CAA Office of Air Navigation Facilities; David D. Thomas, director, CAA Office of Air Traffic Control, and James T. Pyle, acting CAA administrator.



JAMES T. PYLE, acting administrator of the CAA, is in jump seat at left; David D. Thomas, director CAA Office of Air Traffic Control, is flying as co-pilot of the Boeing 707.

CAA, Airlines Protest CAB Penalty Plan

Washington—A proposed Civil Aeronautics Board ruling that would impose penalties on airlines for unrealistic scheduling of flights is meeting stiff resistance. Even the Civil Aeronautics Administration has made one of its rare appearances before a CAB oral argument to file its protest.

Sole proponent of the proposal is the Air Line Pilots Assn., which has fought vigorously over two years for such a ruling. Clarence Sayen, ALPA president, took a firm stand against the airlines during the oral argument, accusing them of publishing schedules "to attract passengers to a service they are unable to provide."

Essence of the proposed ruling requires that 75% of the scheduled trips actually flown by an air carrier each month must operate on time. Violations of the on-time requirement may result in a CAB order directing the airline to revise its schedules on a more realistic basis unless the airline can show that the delays were caused by conditions beyond its control.

Why the CAB Ruling

The proposed rule defines on time as an arrival no later than five minutes after posted scheduled arrival time of trips less than 1,000 miles and no later than 15 minutes on trips exceeding 1,000 miles. Cargo flights are excluded from the ruling.

The proposal stemmed from charges that many airlines are publishing schedules which do not accurately reflect quoted times of departure and arrival. It has condemned such practice as delinquent service unfair to the traveling public. The Board also charged that unrealistic scheduling diminishes the value of airmail service and hampers the Post Office in moving mail on a priority basis.

During the oral argument, Sayen cited several instances of what he called unrealistic scheduling. He accused Pan American World Airways of operating only three on-time flights from July 14 through Aug. 31 from the West Coast to Honolulu.

He said that, because of action taken by ALPA, Trans-World Airlines revised its non-stop transcontinental flights upward by one hour and 14 minutes after operating for one year without once meeting the schedule. Since then, he added, the trip (Flight 19) was on time three times during the month of July and once during the month of August.

ALPA, however, refused to agree with CAB on the tolerance period for on-time flights and has suggested a tolerance of three minutes for all trips, regardless of distance rather than the proposed five and 15 minutes.

The CAA was represented at the oral arguments by George Moore, chief of schedule operations of the Air Carrier Safety Division. Moore said CAA's interest in the matter rested on the remote possibility "that the proposed ruling might be detrimental to safety."

His principal concern, Moore said, was that pressure to meet the schedules might be exerted on ground and flight crews as a result of the rule and cause an adverse effect on the quantity and quality of maintenance and flight operations.

Airline Stand

Pilots, he said, might cut corners, make straight-in approaches or attempt other short cuts in an effort to avoid any penalties. He said the ruling will give rise to controversy when airlines attempt to show that reasons for delays were beyond their control.

On the latter point, United Airlines pointed out that the CAB, in administering the program, would be required to check some 228,000 flight segments monthly, notify airlines of violations and evaluate explanatory statements from the airlines.

United also warned that the ruling would require monthly schedule changes that would break the traditional semi-annual schedule changes to which passengers have become accustomed.

American estimated that the ruling would cost it an additional $8 million annually. A spokesman for the company said 3,062 hr. and 41 min. would have been added to schedules during the month of April if the 75% ruling had been in effect at that time. He added that American gets $455 per ramp hour from its present fleet and, therefore, if 3,062:41 hr. of flying time were eliminated, the airline would lose $1,400,000 in revenues in one month or more than $16 million annually.

Why Delays

Continental Airlines estimated that its operating expenses would be increased by $1,593,837 annually if the ruling were applied. And, it added, additional capital amounting to $930,000 would be required.

John Collins, TWA executive vice president, said a study of a series of flights showed that only 49.6% of the trips were completed without encountering some type of non-routine operations. Of this group, he said, 37% were sufficiently affected by storms or weather to demand some action in order to continue the flights.

In general, the airlines, represented by the Air Transport Assn., argued that schedules are realistic and that the great majority of delays were beyond the control of the airlines. Air Transport Assn. President Stuart Tipton said, "Nobody is more interested in on-time performance than the airlines, because their welfare depends on the service they offer the public." He added:

"Most delays would occur regardless of the scheduled time of flights and are beyond the control of the airlines."

Tipton said that most causes of delays resulted from weather, traffic congestion, late-mail delivery, late limousine arrivals and ramp congestion. Collins said his studies showed 12% of TWA's flights were delayed by airways or air traffic control and 9% were affected by military restrictions.

American included mechanical reasons, connecting passengers and the accommodation of stand by passengers as major contributing causes of delays. The airline also emphasized that a delay of one flight creates a chain-reaction, causing a series of late departures and arrivals, none of which can be attributed to unrealistic scheduling.

Late Limousines

A single daily flight from Kansas City to Chicago was used as an example during Braniff Airways' protest of the rule. The airline said this particular flight was delayed eight times in one month because of late limousine arrivals. Under the proposed regulation, Braniff said, "We will be required to revise our entire schedule pattern the following month because one flight was delayed eight times."

The Conference of Local Airlines charged that the ruling would seriously interfere with the quick-stop type of operation required of local service carriers. It was pointed out that the longest hop in the entire local service industry was 346 mi. with an average of 77 mi. On a typical 462 mi. flight, a conference spokesman said, there are six takeoffs and six landings.

On short flights, once a delay has occurred, there is no opportunity to make up time while the airplane is airborne, the conference spokesman said.

Helicopter Air Service, Los Angeles Airways and New York Airways filed protests on the basis that helicopter techniques are not, and should not be, firmly established at this time. The group said they are experimenting with various patterns of helicopter service and are not yet ready to cope with the proposed rule.

Port of New York Authority and Air Transport Assn. Debate Movie

By Glenn Garrison

New York—A dispute between the Port of New York Authority and Air Transport Assn. over the public relations value of ATA's new movie, "Mr. Withers Stops the Clock," broke into the open last week as the Port Authority released letters critical of the film.

ATA in reply defended the movie as an important industry tool and pointed out that PNYA had raised no objections during consultations with the film's producer while the script was in preparation.

"Mr. Withers" dramatizes the paralyzing effects upon a community when its airport is magically closed by a fantastic character who epitomizes resistance to progress. One of the reasons Mr. Withers dislikes the airport is because of aircraft noise, a sensitive subject in the New York area.

Austin J. Tobin, executive director of PNYA, called the film "guilty of many critical public relations errors." He contended that it caricatured public officials in airport communities, and added that "since Newark Airport was the only United States airport that was closed, the film points a finger directly at Mayor Leo Carlin of Newark." To him said the Newark mayor would "hardly be flattered by the misrepresentation of his integrity, personality and appearance" (if identified with Mr. Withers in the film).

In the Sept. 20 letter, which was addressed to Admiral C. E. Rosendahl of the National Air Transport Coordinating Committee, Tobin also wrote that "people who suffer from the noise of aircraft have a justifiable interest in seeing that everything possible is done to reduce, if not eliminate, the noise problem. How, then, would they react to the incredible presumptuousness of 'Mr. Withers Stops the Clock'?"

Tobin requested a meeting of NATCC's executive board to discuss the film "if there is any intention on the part of ATA or NATCC to sponsor showings in the metropolitan area of New York or New Jersey." He expressed the view that showings of "this objectionable movie" could have "grievous and destructive effect on the public relations of all of the members of NATCC if exhibited in this area."

NATCC is the industry group formed immediately after the crashes at Newark Airport and includes PNYA and ATA in its membership.

In the second PNYA letter, dated Sept. 24 and addressed to Willis Player of ATA, Director of Aviation John R. Wiley said that "such an approach to the aircraft noise problem in this, the busiest center of world air transport, would in my opinion be disastrous."

In a letter last week to Tobin, ATA President Stuart G. Tipton said "we cannot share your view" as to the movie's faults. He contended that the film emphasizes the "human values" of an airport as well as economic considerations.

A press showing of the film has been scheduled for Oct. 25 in New York. Tipton wrote Tobin, and the PNYA director is cordially invited to attend it.

Replying to Wiley, ATA's Player expressed sorrow that "we've reached a point of public disagreement." The movie, Player wrote, was "not developed in a vacuum" but was checked with airport officials and public relations experts.

"I am sure you will forgive me for noting," Player wrote, "that we have a special perplexity with respect to your present views." The producer of "Mr. Withers," Player said, consulted with Port Authority representatives and received Port Authority cooperation during production of the film. At PNYA suggestion, Player said, the film's title was changed from "The Day They Closed the Airport."

Meanwhile, NATCC's Rosendahl said his organization's executive committee had not met to discuss the film and "at the moment I do not know whether the chairman expects to call a meeting." C. R. Smith, American Airlines president, is executive committee chairman.

NATCC would have no further comment, the admiral said, pending results of such a meeting "if it is called."

Air-Minded Political Campaigns Will Bring Carriers $1.5 Million

By Katherine Johnsen

Washington—This year's political campaign has developed into a million dollars-plus business for the airlines.

Air travel by candidates and speakers in the national campaign will bring in an estimated $1.5 million—double the dollar volume of the 1952 campaign. This does not include press flights in the national campaign and air travel used in local campaigns both of which add up to a sizable business.

The dollar-volume of charter flights in 1952 was approximately $375,000. The outlook is that this will rise to $750,000 in 1956. Airline spokesmen estimate that the charter business reflects less than 50% of the national political business. Individually scheduled flights account for more than 50%.

Robert Humphreys, campaign director of the Republican National Committee, reports that about 95% of the travel booked by Republican headquarters this year will be by air, as compared with about 60% in 1952.

The shift to air has changed campaign techniques. The shorter hop "whistle-stopping" by air—after the fashion of former President Truman's 1948 campaign by rail—will be the exception rather than the rule. Experiments with this technique, Humphreys said, have been unsuccessful for the most part. Access roads to many airports in poor parking facilities are inadequate for large crowds, the weather cannot be counted on.

The first political campaign tour via air was in the 1936 Roosevelt-Landon contest. John D. M. Hamilton, Republican national chairman at the time, chartered a DC-2 for hops through 16 western states. On this tour, the DC-2, then one of the largest aircraft flying, was the attraction that drew the crowds and the publicity.

The Republican National Committee now has seven chartered aircraft—including the President's Columbine—flying in the campaign. Regular charter charges are being paid to the government by the committee for the political flights of the Columbine.

The bulk of political business in this campaign, as in 1952, is going to American Airlines and United Air Lines. American estimates that its dollar volume of charter business from the two National Committees thus far at $70,000 as compared with a total of $95,000 for the entire 1952 campaign. United reports its political charter business so far at $50,000.

Delta Opposes CAB's C&S Mail Decision

Washington—Delta Air Lines has attacked a decision by the Civil Aeronautics Board to reopen the Chicago & Southern international mail rate and has asked the Board to reconsider its action.

The CAB reopened C&S international mail rates for the period between Dec. 16, 1950, and July 31, 1952, early

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Eight types of
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TYNE — VICKERS VANGUARD; LOCKHEED ELECTRA

Rolls-Royce gas turbines have already flown more than 1,250,000 hours on scheduled airline service

ROLLS-ROYCE AERO ENGINES LEAD THE WORLD

last month (AW Sept. 17, p. 45).

Delta denied receiving any "windfall" from the rate, which applied to C&S before Delta absorbed the airline. The airline also contended that the rate has never been challenged and pointed out that the rate has been considered closed and final for over five years.

Noting that the importance of the case to Delta cannot be overemphasized, the airline's petition said the Delta-C&S merger was subject to "the sole contingency that Delta might be required to refund mail revenues representing allegedly excess domestic profits ranging between zero and $654,000."

"There is no gainsaying the fact that the Delta-C&S merger never would have been consummated had Delta known that this second contingency existed—at least without provision affording Delta reasonable protection," the carrier's petition said in comment on the possibility that the CAB may try to recapture more than $1 million.

Delta argued that the CAB does not have the legal power to make a retroactive adjustment of the C&S international mail rate for the period after Dec. 16, 1950 on the basis of actual operating results.

Arguing against all the Board's findings, Delta said that, assuming the CAB had the power to review the rate, it is not required by law to reopen the rate. Delta also said the CAB erred in reopening the rate at all, but that, if the rate must be reopened, it should only be reopened for the period Dec. 16, 1950, to Sept. 30, 1951.

Two Carriers Offer Air-Sea Tours

Trans World Airlines and American Export Lines beginning Oct. 15 will offer the first combination air-sea package tours, according to a joint announcement last week by the airline and the steamship company.

Under the unique plan, transatlantic travelers may choose from 12 tours with costs starting at $698 for a two-week tour of Europe. A week at sea, a week in Europe, and an overnight return flight from Paris to New York are included in this basic all-expense package.

The other tours will range up to $1,398 for a five-weeks trip.

TWA and AEL offices in the U. S. and Canada and travel agents serving the two carriers will sell tickets and make reservations for the tours in single transactions. The air-sea cruises will also be offered through TWA's time payment plan.

Warren Lee Pierson, TWA chairman, predicted that the joint program will reach additional thousands of short time vacationers who wish to enjoy the "unique luxury of ship travel with the speed and comfort of air travel." AEL President John E. Slater said the plan will introduce a "bright new era in transatlantic transportation" and reach new mass markets.

Interline agreements between airlines and ship companies have existed for exchange of tickets, but the TWA-AEL plan is the first arrangement by which such carriers have coordinated their facilities to offer inclusive tours to Europe, the announcement said.

International Aviation Agreements Approved

New International Civil Aviation Organization joint support agreements have been made to cover financing, manning and operation of air traffic, meteorological, and telecommunication services and radio navigation aids in Iceland, Greenland and the Faeroe Islands.

The agreements were approved at a recent 14-nation conference at Geneva called by the council of ICAO.

The conference decided that joint financing should be handled by agreements between the interested states and the council rather than by relying on bilateral agreements between the council and the governments of Denmark and Iceland.

The new agreements become effective Jan. 1.

Total cost of the services for one year is not to exceed $1,076,562 for Iceland and $1,734,525 for the Danish locations. The contracting governments will share 95% of the costs proportioned by aeronautical benefits derived, with Denmark and Iceland paying 5% for indirect benefits received. Aeronautical benefits are based on number of civil aircraft crossings between North America and Europe.

The conference also recommended a special council meeting later this year to consider provision of VHF forward scatter system speech circuits to link the principal air traffic control centers of the North Atlantic region.

Britannias for Northeast

Northeast Airlines was expected to sign a contract late last week for five Bristol Britannia turboprop transports for use on the airline's new Florida-New York route. Delivery on the $17 million order was reportedly scheduled to begin in the fall of 1957 in time for Northeast to use the British transports during the heavy winter season in Florida. Northeast plans to start its first service on the new route on Nov. 27 with five Convair 240 flights a day between Washington and New England.

Swissair Orders Third DC-8 for 1961 Delivery

Swissair has ordered a third DC-8 jet transport. Costing about $6 million without spares, the plane is scheduled for 1961 delivery. Swissair's two previously ordered DC-8s are due for 1960 delivery.

All three of the Swissair jets will be powered by Pratt & Whitney JT4 (J75) engines.

PanAm Subsidy Cut Off by CAB

Washington — Civil Aeronautics Board last week cut off Pan American-World Airways' subsidy and put the international airline entirely on a service rate.

The CAB reopened Pan American's system mail rates which had been effective since Jan. 1, 1955, and ordered the airline to show cause why its mail pay should not be temporarily set at the service mail rates that are now in effect.

The Board said Pan American's system mail rates were set on the basis of forecast revenues, expenses and investment, and that these forecasts are approximately one year old. In view of the airline's profit record during the past year, the Board is opening the rates to find out whether they have become excessive.

The CAB said it has reviewed Pan American's latest reports "in light of the Board's continuing responsibility to review outstanding mail rates in order to guard against their becoming unfair and unreasonable and the obligation to institute proceedings looking toward decrease of such rates if they should become excessive."

Reviewing Pan American's progress over the past year, the CAB observed that first-class fare increases became effective April 1, 1956, and that off-season discounts were eliminated on Oct. 1, 1956.

The Board said neither of these factors was considered in setting Pan American's mail rates.

In the period ending June 30, 1956, Pan American had a return of 7.59% without capital gains and a return of 9.6% including capital gains. The Board also noted that the airline is currently experiencing substantial growth in traffic and revenues.



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It is *guaranteed* to add 20 m.p.h. to the cruising speed of your DC-3!

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CAB Investigates Hughes-Northeast Link

By Craig Lewis

Washington—Civil Aeronautics Board has ordered an investigation of the relationship between Howard Hughes and Northeast Airlines to determine whether Hughes has established common control of Northeast and Trans World Airlines.

The investigation is the latest in a series of by products of the important New York-Florida Route Case. Several investigations already are under way of a CAB leak which is blamed for abnormal activity in Northeast stock the day after the Board made its secret decision to give the airline a new route (AW Aug. 20, p. 38).

Atlas Stock

The Hughes investigation will look into the relationship between Hughes, Atlas Corp. and Northeast Airlines to determine whether Hughes, who owns 11% of the Atlas stock controls Northeast through Atlas. Atlas owns 50% of Northeast's stock.

The investigation order was issued at the same time that the CAB issued its formal decision and order in the New York-Florida Case. The decision confirms the Board's earlier announcement that Northeast would get a New York-Miami route and sets an effective date of Nov. 27 for the new service.

The New York-Florida decision substantially rearranges the competitive pattern on East Coast airline routes. Northeast will offer new competition for Eastern Air Lines and National Airlines on the long north-south routes. Northeast, Eastern and National will offer new competitive turnaround services to American Airlines in the Washington-New York-Boston markets.

The investigation of Hughes-Northeast ties grew out of the New York-Florida Case. While the case was in progress Eastern and National complained that Hughes, who controls TWA, had acquired holdings in Atlas through which he could exercise control of Northeast.

RKO Merger

Hughes obtained his Atlas stock when he merged the corporate shell of RKO Pictures Corp. with Atlas. In exchange for his RKO stock, Hughes received approximately 11% of Atlas' common stock.

Now the Board will investigate to determine whether the Hughes-Atlas-TWA-Northeast relationship is subject to provisions of the Civil Aeronautics Act and whether Hughes should have asked the Board for the same type of approval he obtained for his acquisition of control of TWA in a 1944 CAB decision.

In the Florida Case, Northeast denied that Hughes controls Atlas and said Hughes does not intend to exercise the voting rights of his Atlas stock. In its decision, the CAB said the control question warrants close scrutiny, but that it is not the type of violation that should bar Northeast from getting its new route.

Efforts to find out who leaked the CAB decision before it was announced are continuing with the Board, the Securities and Exchange Commission and the Department of Justice all working on the case. The Senate Permanent Investigating Subcommittee staff is preparing its own investigation of the leak.

The Board was sharply divided on the issue of choosing a new carrier for the New York-Miami route, although the vote was unanimous on other route awards to Eastern, National, Capital, Delta, United and TWA. Chairman James R. Durfee, Vice Chairman Joseph P. Adams and Member G. Joseph Minetti formed the majority favoring Northeast for the route. Members Harmar D. Denny and Chan Gurney voted for Delta, which also was the examiner's choice.

Why Northeast Was Chosen

The majority based its decision to a great degree upon the fact that Northeast is the only trunk airline still needing subsidy. Another important factor in the decision was the fact that the New York-Florida Case was probably the last chance the CAB would have to strengthen Northeast's position. The decision said in part:

"Extension of Northeast to Florida will, in our judgment, eliminate the carrier's current subsidy need of more than $1.5 million annually and at the same time enhance the carrier's ability to provide needed short-haul services within the New England regional area which it now serves."

Pointing out that Northeast has received less in the way of strengthening route awards than any of the other trunklines, the Board added that other regional carriers have reached self-sufficiency largely because of the CAB policy of authorizing them to expand into long-haul, high-density markets.

The majority's opinion observed that "this case provides the last opportunity to accord similar treatment for Northeast."

Another factor in the choice of Northeast was the Board's judgment that the New England carrier would divert less revenue from Eastern and National than would Delta, Capital or Pan American, the other leading applicants for the route.

CAB Member Denny filed a long and detailed dissent in favor of Delta over Northeast. Gurney concurred with a short dissent of his own.

Denny called the new route award "a tail-wagging-the-dog extension which bears no logical relation to Northeast's present route system." He said the New York-Florida market needs a third carrier "equipped and fully qualified to provide a truly effective competitive service" and that Northeast fails to meet the test.

Denny's Dissent

The dissent said that the attention and energies of Northeast management will be split between the new long-haul market and the old New England market so that the quality of both operations will suffer. It also said the airline's past operational experience does not qualify it for the competition it will meet.

Denny disputed the majority contention that the award comes under the recent policy of strengthening smaller carriers.

He said he does not "interpret the recent area cases standing for any such proposition that route awards should always go in favor of the smaller carriers rather than the medium-size or larger carriers."

The area cases involved are the New York-Chicago, Denver Service and Southwest-Northeast Services Cases, all decided within the past year. In these cases, the CAB generally favored the smaller carrier in handing out new routes.

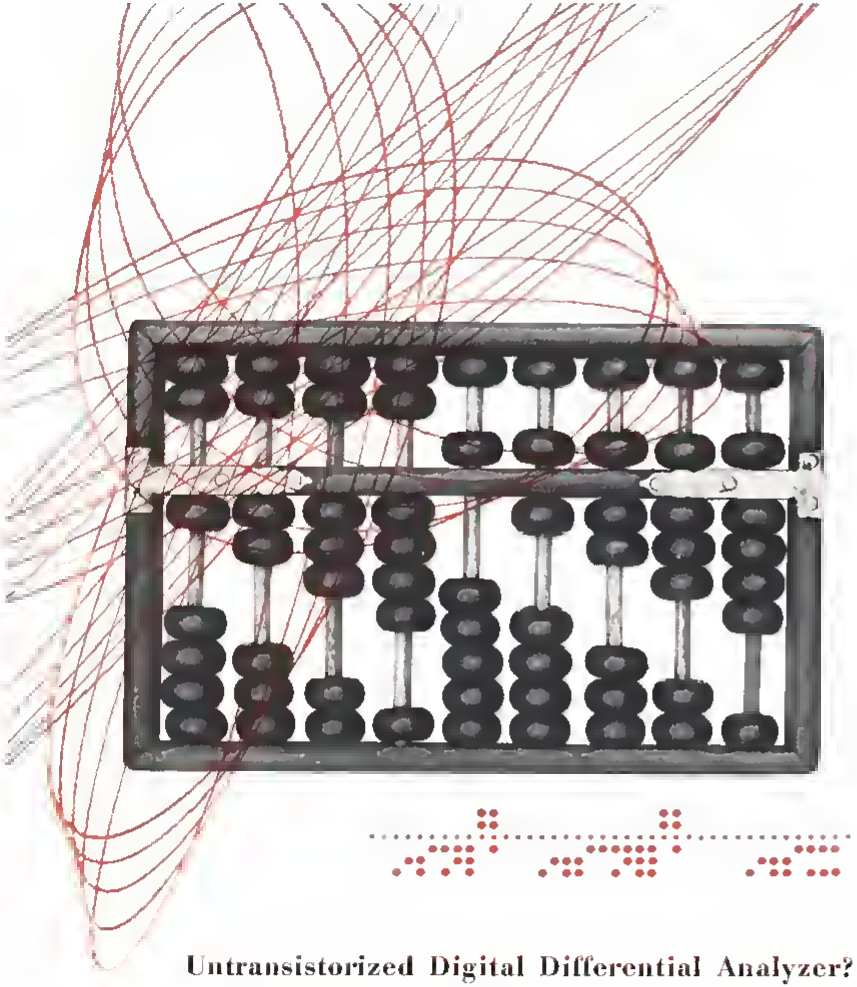
Small Carrier Policy

The Board consistently stated that its purpose was to strengthen the smaller carriers and to close the size gap between them and the Big Four.

In his dissent, Denny said that the logical way to improve Northeast's position would be to reclassify the airline as a local-service carrier and recognize that subsidy would be needed until load factors increase, local routes are improved and a more efficient short-haul aircraft is developed.

Another sound approach, Denny said, would be a merger with another regional or local-service carrier. He said either of the two solutions would solve Northeast's problems more effectively than the Florida route extension.

Gurney also maintained that the CAB investigation of the relationship between Hughes Atlas and Northeast should be completed "before and not after the award of this route to Northeast."



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Shortlines

▶ **Air France** traffic rose 24% to 991,298 passengers in the first half of the year. System load factor for the period was 71%, passenger miles flown were up 19% over the same period of 1955.

▶ **American Airlines** supplied in-flight passengers with World Series scores again this year. It will provide scores on major football games this fall.

▶ **Cubana** has ordered a third Super-G Constellation to handle traffic increases on the Cuban carrier's New York-Havana route. The transport will be delivered next summer and will be operated in an 86-seat, mixed-class configuration.

▶ **International Civil Aviation Organization** members have approved new agreements for financing and operation of weather and navigation facilities in Greenland, the Faeroe Islands and Iceland.

▶ **Los Angeles Airways'** report for the first half of 1956 shows operating revenues of $164,776, and total income—including subsidy—of $519,357. The helicopter air line had a net loss of $26,964 for the six-month period, but this is subject to adjustment as soon as the carrier's current mail rate case is decided.

▶ **Pacific Northern Airlines'** operating revenues totaled $4,461,339 in the first six months of the year. Net income for the period was $487,788, including $375,597 in mail pay received for previous periods under terms of a CAB decision.

▶ **Pan American World Airways** has completed a $310,000 construction project at San Juan's new Isla Verde Airport. Pan American built a new nose hangar and paved a maintenance area with six aircraft service positions.

▶ **Swissair** has ordered a third DC-8 for delivery in 1961 at a cost of $6 million without spares. Swissair is offering 21-day tours to Yugoslavia in cooperation with American Express.

▶ **Trans World Airlines** has installed a television bulletin board at its Kansas City airport ticket counter to give passengers the latest information on arrivals and departures.

▶ **Work** is expected to be completed late this month on $400,000 one-story brick air terminal building at Natrona County Airport at Caspar, Wyo.

AIRLINE OBSERVER

▶ **Israel's last-minute approval** of the 15-day transatlantic excursion fares was made with reservations. The government has asked for a time limit extension on the new rates, which went into effect on Oct. 1, from 15 to 17 days but would prefer 21 days to allow visitors more time in Israel. Israel also wants a fare reduction on the Israel-Europe portion of a passenger's ticket "to correspond with the reduction on the transatlantic portion." Present reduction affects only the U. S.-Europe segment of the ticket.

▶ **Netherlands government** committee has turned thumbs down on a proposed subsidized helicopter service as too costly. The committee concluded that—for the present, at least—regular helicopter service cannot be operated without serious losses.

▶ **Air traffic controllers** are not happy with recent revision of grade standards authorized by the Civil Service Commission (AW Oct. 1, p. 41). They contend that the pay increases are so limited the pay adjustments will not halt the flow of controllers to private industry.

▶ **Northeast Airlines** plans to increase its personnel roster by 1,300 to handle the recently acquired New York-Florida route. For the first time in the airline's history, no employe termination papers will be issued as the peak New England summer traffic season slackens.

▶ **Real-Aerovias**, the Brazilian airline, has purchased **Nacional**, another Brazilian carrier, and now claims to be one of the 10 largest airlines in the world. With Nacional's fleet, Real has 110 aircraft, including 87 DC-3s, 10 Noorduyn C-64s, 10 Convair 340s and three DC-4s. Carrier extended its service from Buenos Aires, Rio de Janeiro and Miami to Chicago Oct. 5.

▶ **Scheduled airlines** operating in New York State have agreed to hire Negroes in all job categories, including flight operations. The airlines reaffirmed their policy of non-discrimination in considering applications for employment and stated judgment of personnel will be based on merit without regard to race, creed or color.

▶ **Vickers** is counting on two large underbelly freight holds of the Vanguard as a prime selling point to airlines wrestling with load peaking problems. These two cargo holds can carry full 21,000-lb. payload of the Vanguard without disrupting passenger cabin seating arrangements. Vickers is promoting the philosophy of using the Vanguard as a high density passenger carrier during peak daytime schedules and then operating it primarily as a freighter during the night when passenger traffic is light.

▶ **Transport manufacturers** expect a temporary lull in airline equipment buying until the impact of the Convair 880 and other medium-range jets is evaluated against Lockheed Electra and Vickers Vanguard turboprop designs. Watch for key airlines to make their decision by next spring.

▶ **New air freight service** between Europe and Red China has been opened by Aeroflot agreement with Finnair. Through freight shipments will be carried from European points to Moscow by Finnair, from Moscow to Chinese and Siberian destinations by Aeroflot. Single shipments are limited to 60 lb. weight, and cubage will be dictated by the small loading doors of Aeroflot transports.

▶ **Officials of Czechoslovakia's** national airline have expressed interest in visiting Vickers Viscount production line at Hurn. Czechs say they are interested in the possibility of using Viscount replacements for their current Ilyushin 12 fleet. The Tupolev 104 jet transport that already has visited Prague on proving flights is too large for their route structure.

▶ **Civil Aeronautics Administration** is negotiating with Navy for Sikorsky S-58 helicopter equipped with automatic stabilizer gear and other equipment for instrument flight. The CAA hopes to use the aircraft in a planned study of navigational and air traffic control problems in inter-city helicopter operations.

U.S. payrolls are larger because of American travel abroad



Over 70% of the people going overseas this year will go by air. The dollars these tourists leave in foreign countries are the best friends world trade ever had.

Hundreds of thousands of working people in the United States are busier because of U. S. export trade. Last year, these exports reached the *fourteen billion* dollar mark.

Where did foreign countries get the dollars to pay for our exports? Over a billion were *tourist dollars* and the greatest single source of dollars for many, many countries.

The potential for even greater tourist expenditures is very large indeed. *Slightly more than one percent of all Americans—only 1,700,000—will go overseas this year though 40,000,000 are actually in a financial position to do so.* The rest may think about it, read about it, dream about it.

But one day the 40,000,000 Americans will *all* go. That's the goal to which the airlines of the world are dedicated.

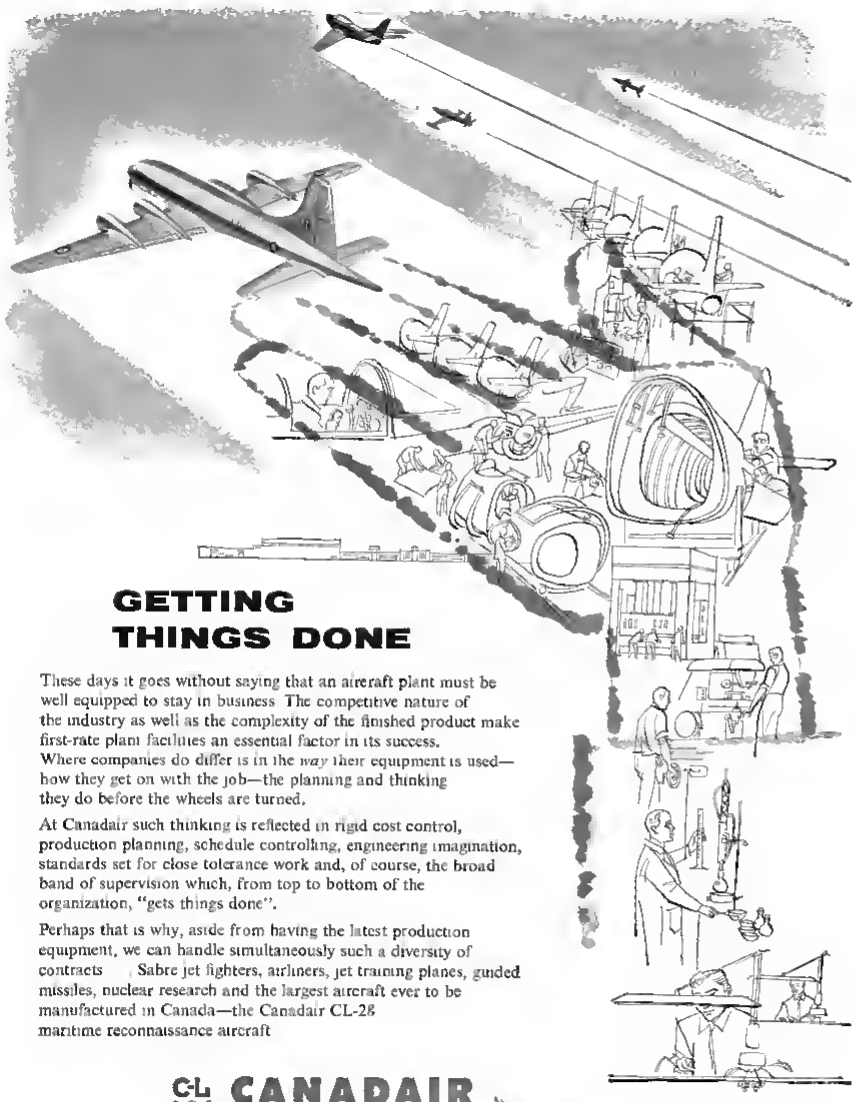
The postwar surge of travel abroad has consistently been paced by the development of international aviation. High-speed, long-range, large-capacity airliners have been one element of this developmental process. Another has been the low-cost, international tourist-fare services pioneered by Pan American . . . and now available all the way round the world, and on all the major airlines of the world.

So, as foreign vacations continue to become more and more a reality for millions of Americans—*even those with no more than 2 weeks off from work a year*—so will the whole world become a larger and larger market for U. S. exports.

The first responsibility of an airline is to be a useful citizen.

PAN AMERICAN WORLD AIRWAYS

WORLD'S MOST EXPERIENCED AIRLINE



GETTING THINGS DONE

These days it goes without saying that an aircraft plant must be well equipped to stay in business. The competitive nature of the industry as well as the complexity of the finished product make first-rate plant facilities an essential factor in its success. Where companies do differ is in the *way* their equipment is used—how they get on with the job—the planning and thinking they do before the wheels are turned.

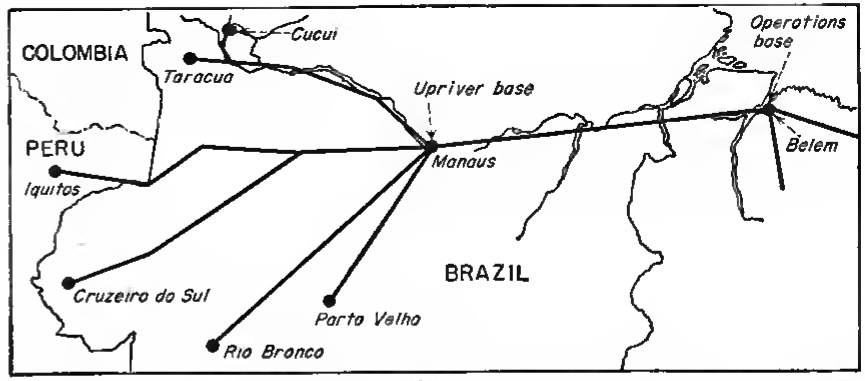
At Canadair such thinking is reflected in rigid cost control, production planning, schedule controlling, engineering imagination, standards set for close tolerance work and, of course, the broad band of supervision which, from top to bottom of the organization, "gets things done".

Perhaps that is why, aside from having the latest production equipment, we can handle simultaneously such a diversity of contracts . . . Sabre jet fighters, airliners, jet training planes, guided missiles, nuclear research and the largest aircraft ever to be manufactured in Canada—the Canadair CL-28 maritime reconnaissance aircraft.

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PANAIR DO BRAZIL'S Amazon River route encompasses 5 000 mi., fans out from Manaus in Central Brazil along five Amazon tributaries

Panair's PBY's Haul Snakes, Mail, People

Rio de Janeiro—While most of the world's airlines are looking forward to the speed of jet propelled transport, one airline in Brazil is planning to stick with an old U. S. Navy workhorse—the PBY Catalina—as being best suited for at least one phase of its operations. Panair do Brazil (48% owned by Pan American World Airways) uses the old Navy World War II amphibian for its routes along the Amazon River and tributaries, and plans to keep on using it for sometime to come.

The route runs from an operational base at Belem on the southern lip of the Amazon mouth, upriver to the bustling jungle metropolis of Manaus. It fans out from Manaus, stretching out into five Amazon tributaries to points in Peru, Colombia, Venezuela and the Bolivian border.

Rugged Workout

Panair gives its four Catalinas a rugged workout for this Amazon service of more than 5,000 unduplicated route miles.

Last year the Catalinas lugged 17,139 passengers, 455 (metric) tons of cargo and 35 tons of mail up and down the jungle rivers with more than 90% of all landings being made on water.

This year the Amazon service will have to be expanded, says Panair's traffic department. Trade along the Amazon is booming. One of Panair's best customers is Petrobras (national oil monopoly) which is demanding several special flights a week for its drilling and exploration crews. Petrobras is increasing its Amazon exploration (to the east of Manaus) in a desperate attempt to put Brazil on a producing oil basis (the country now imports 98% of its oil). To keep up with the Amazon traffic, Panair plans to buy two more Catalinas, put in more crews and ground radio aids.

As it is, Panair's Catalinas have been modified for Amazon use. The plane's original pug nose (for a machine gun mount) was chopped off and given a beauty treatment. Pilots complained that the original nose made good vision difficult. Amazon pilots have to rely most of the time on close visual contact to follow the river as you would a road. To remedy this, engineers curved the top part of the bow down and away from the flight deck windows. The undersection of the bow also was remodeled to look like the flying-V shape of a speedboat hull. This made for smoother, easier landings.

Searing Heat

The body of the plane was painted white on top to reflect the searing equatorial heat of the Amazon Valley. The inside was divided into three sections. Forward and rear compartments take cargo while the center is fitted out with heat-insulated plastic for passengers. An extra hydraulic pump was installed to give emergency power for landing gears in case an engine failed. Previously, the Catalina had to rely on hydraulic power supplied only when the engines were running.

Panair mechanics tell you that the only real bug in the Catalina they can



PANAIR'S PILOTS and engineers say Catalina's Pratt & Whitney engines hold up well in blistering heat and under rugged takeoff conditions which are standard operation.



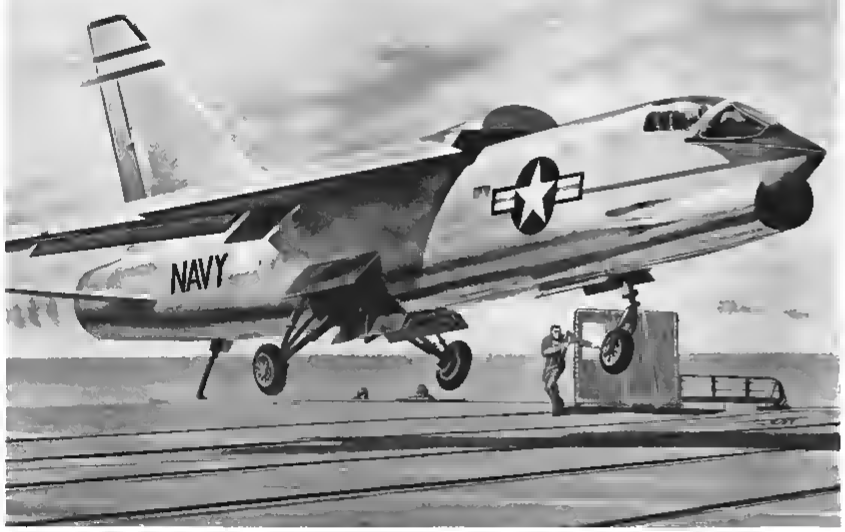
Catapult Officer gives the signal and the Vought F8U-1 *Crusader* is hurtled along the deck by the Forrestal's steam catapult.



—airborne in a matter of seconds, the *Crusader* streaks skyward at a speed never before attained by a Navy jet fighter.



—while below, the mighty Forrestal's size and speed dramatize the devastating long-range striking power of the New Air Navy.



1000 + mph *Crusader* qualifies aboard ship!

SPECIAL WITH THE USS FORRESTAL AT SEA. Aviation history was made aboard this new attack carrier when the flashing Chance Vought F8U-1 *Crusader* successfully completed its shipboard qualification trials.

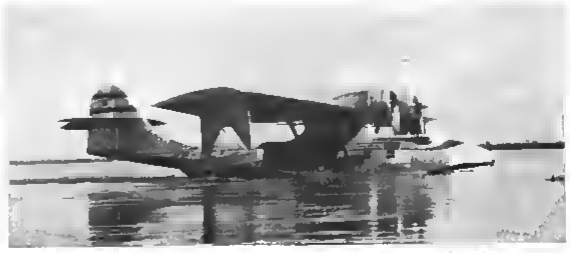
The trials, held off the Atlantic Coast, marked the first time that an aircraft capable of level flight speeds in excess of 1,000 miles an hour had ever operated from a carrier deck.

Designed and built by Chance Vought, the *Crusader* met all of the Navy's stringent shipboard operating requirements like a champion. This blazing new air superiority fighter soon will be assigned to active duty with the Fleet, adding 1,000 miles-an-hour-plus performance to the growing strength of America's Defense Team.

Scientists and Engineers: There is a challenging place for you on Vought's creative team now. Write J. W. Larsen, Assistant Chief Engineer, P.O. Box 5907, Dallas, Texas.

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DESIGNER AND BUILDER OF HIGH PERFORMANCE MILITARY AIRCRAFT SINCE 1917



PILOTS have to be river boat pilots, watch for reefs, obstructions, sometimes jump over big logs by pouring on quick throttle. Landing areas have to be well-marked.

complain about is the fabric used to cover the ailerons and moving tail assembly parts. The fabric, no matter what you paint it with, rots in the humid Amazon heat after about six months. Mechanics also complain about having to change an engine upriver. The new engine has to be flown up in pieces and reassembled, usually on a sand beach with the plane partly hauled out of the water. The heat and the bugs make this intricate reassembly job almost unbearable. But pilots and engineers say the Catalina's Pratt-Whitney engines work amazingly well in blistering heat and rugged takeoff conditions which are standard daily operations hazards for Panair's sun-burnt, bug-bitten crews on the Servico das Amazonas.

Although few people outside of Brazil know about this Servico das Amazonas, it is not new. The Amazon route was started in 1933 with Sikorsky S-38 equipment and Consolidated "Commodores." In 1935 the original route from Belem to Manaus was expanded and the new service called for the "fast" Fanchild amphibian. Then the Sikorsky S-43 equipment took over the route until 1947. In 1947 the war surplus Catalinas were purchased, remodeled and put into service. They have been on rugged duty ever since with few equipment failures.

Routes Stretched

After the Catalinas were put in service, Panair stretched its river lines to Cucui (border of Venezuela), Iquitos (Peru), Leticia (Columbia), Cruzeiro do Sul and Rio Branco (Bolivian border) and Porto Velho in the newly named jungle territory of Rondonia. Many of the stops along the fan-like coverage of the Amazon Basin are radio stops with nothing more to offer a visitor than a few Caboclo (mixed white and indian people) huts and some canoes.

Panair says it is going to make a promotion push for tourists on the Amazon run by offering special tours in conjunction with PanAm flights through Belem. The Catalinas are fitted out to take 16 passengers and five crew (pilot, co-pilot, radio man, mechanic and steward). Meals are served on board and at some of the jungle stops. A tourist will be able to fly from Belem (after connecting from the U. S. by a PanAm DC-6B) on a Catalina upriver to Manaus. At Manaus the visitor can arrange for other trips along the Amazon line. Afterwards, Panair arranges to put the tourist on board its newly opened Constellation flight across the jungle from Manaus to Rio. Crewmen say the only really good hotels on the service are at Belem, Manaus and Iquitos. The hotel at Manaus, the famous Amazonas, offers air-conditioning and ultra modern bedroom-living room suites.

Weekly Service

Except for the Belem-Manaus and the Manaus-Porto Velho flights (three a week), Panair usually runs weekly service. Overnight stops are made in the end-of-the line cities.

Panair follows the jungle flight custom of never flying at night. The schedules for at least six months out of the year are met fairly well. But for the Amazon winter, the rainy season schedules are a touch and go affair. From January through March, pilots find flying conditions almost impossible. Quite often the pilots have to skim the Catalinas over the rivers at 200 to 300 ft. just to see where they are going. At that altitude all the rivers and the branches look alike unless you know your way. One time a pilot took his Catalina around an island in the middle of the Amazon for nearly an hour before he realized he was flying around in circles.

The Amazon in some parts rises and falls 40 ft. with floods. Airplane pilots also have to be river boat pilots. "When we see a big log coming our way we just pour on full throttle and jump over it," one of the senior pilots said. All landing areas are marked by buoys



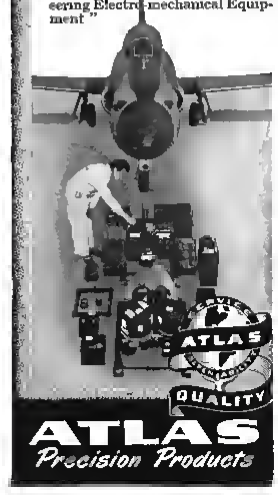
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Below, standard ¼" valve with Bendix connector 10-63212-3P.



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Zero leakage. Internal vent to atmosphere through *controlled outlet* prevents drawing moisture-laden or contaminated air into cavity of moving parts. *Hermetically-sealed coil* assures trouble-proof operation. Solenoid may be rotated on valve body to place electrical connector in most desirable location. This same Clary valve can be used for *"normally open"* or *"normally closed"* service by simple mechanical rearrangement of the solenoid.

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Rated Operating Pressure: 3000 PSI
Voltage: 18-30 D C
Connector: Bendix 10-63212-3P
Packing: AN "O" Rings

Tube Size	Service	Part No. Normally Closed	Part No. Normally Open
DIRECT-OPERATED			
⅛"	2-way	520030	520031
⅛"	3-way	520032	520033
¼"	2-way	520034	520035
¼"	3-way	520036	520037
⅜"	2-way	520038	520039
⅜"	3-way	520040	520041
PILOT-OPERATED			
⅛"	2-way	520042	520043
½"	3-way	520044	520045
⅜"	2-way	520046	520047
¾"	3-way	520048	520049

*Modifications available to meet design requirements.

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Clary AUTOMATIC CONTROLS DIVISION

Clary Corporation, Dept. W106, San Gabriel, California

MANUFACTURERS OF BUSINESS MACHINES, ELECTRONIC DATA-HANDLING EQUIPMENT, AIRCRAFT AND MISSILE COMPONENTS

and are well away from currents and sand bars. Nevertheless, occasional landings have to be made in bad weather in unmarked areas. Quite often when it's really hot, there is little wind and the plane is heavily loaded, pilots have to run the Catalinas for nearly two miles before they can pry them off the water.

Callused Hands

"You can always tell a Panair river pilot by his hands," one said. He explained they get thick callouses on their hands from horsing the big ships off the water. "You have to tug the controls like a bar-bell when you first shove the throttle forward, he said, to keep the nose from acting like a submarine."

The cargo hold on the Catalinas usually looks like a floating store. Clothes, canned food, machinery parts and other stuff is crammed on each flight to keep the river people supplied. For the small river village, Panair's weekly service is a big event. Newspapers and gossip from the crew keeps villagers informed on what's going on in the outside world. Sometimes senators, governors and even presidential candidates stump around the jungle circuit in an attempt to pick up some votes, providing unexpected entertainment for the river people.

Snake Cargo

Going up river, the cargo is pretty routine with the usual supplies and mail. But coming down, it's a different story. According to one Panair steward, you never know what you might find in the cargo hold. The steward recalls one evening when he told some Indian cargo loaders to put a few boxes lined on the bank into the plane for the overnight stay. The boxes were destined for the Belem cargo depot for trans-shipment abroad. One was of considerable size with holes drilled in the sides. The next day the steward got a shock when he opened the compartment door.

"There were ten or twelve little snakes tearing around the floor and over the seats," he said. He quickly slammed the door and told the grinning native stevedores to go in and corral the snakes. When all was calm, it was learned that the big box with holes contained a 15 foot boa constrictor that was resting quietly after giving birth to the brood of little snakes which had crawled through the air holes in the box. The snake had been ordered by a foreign zoo. Another down river cargo specialty is cans of tropical fish destined for aquariums in the United States.

"The river life is tough at first but then, after awhile, you really get to like it. I often wish I was back up there," says Capt. Hugo Fischer, a former Amazon Catalina pilot who is now on one of Panair's European Constellation flights.

"Now we have to put our trust in instruments. In the Amazon the only instruments I trusted were my eyes. . . that was real flying," Fischer says, looking at his hands. The callouses are almost gone.

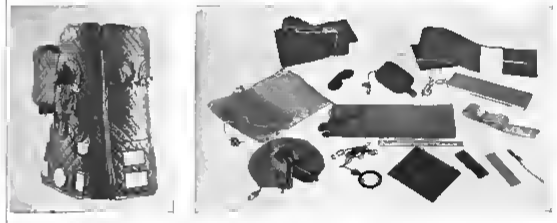
National, TWA Order Electronic Systems

National and Trans World Airlines have ordered system-wide electronic reservations systems, each the first of their kind, slated for operation late next year. The systems will be produced by Teleregister Corp., which built all the airline automatic reservations systems now in use.

• National Airlines system will enable its agents at key cities (New York, Philadelphia, Washington, Norfolk, Jacksonville, Tampa, Miami and New Orleans) to interrogate instantly a magnetic inventory drum (reservisor) in Miami by means of the familiar agent sets for space on any NAL flight up to six months in advance. If agent sells available space, the inventory record is instantly and automatically adjusted in the Miami Reservisor to reflect the sale. Agents at other NAL



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Shape designed for zero wave drag described in Aviation Age, June, 1956



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20 kva



17 kva

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Scheduled for service on advanced aircraft, these J&H generators promise to be the ultimate approach to aircraft electric power.

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J&H Model	33051-004	30052-001	5125 1	3150	31152-004	8280-1
Nominal Rating	2.5 kw	12.3 kw	100 amps	40 kva	20 kva	17 kva
Volts	d-c	a-c, d-c 3 outputs	3 outputs	30	120/208	120/208	120/208
Speed (rpm)	12,000	12,000	8,000	8,000	8,000	12,000
Phase (qty)	—	—	—	3	3	3
Frequency (cps)	—	1,600 400	—	400	400	400
Power Factor (min)	—	—	—	.75	.75	.75
Weight (lb)	30	70	36¼	165*	100*	50
Length (in.)	12.71	14.3	10.57	27.25*	24.0*	12.85
Diameter (in.)	4.5	7.75	6.5	13.0*	9.5*	7.5

*Includes Integrated Constant-Speed Drive

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JACK & HEINTZ AIRCRAFT ELECTRIC EQUIPMENT

stations will be able to interrogate the Miami Reservisor by means of specially coded teletype messages.

• **Trans World Airlines** system will provide space availability information on domestic flights for 31 days in advance and overseas flights up to six months ahead. TWA will install magnetic reservisors at New York, Chicago and Los Angeles. When an agent requests space by means of his small agent set, the request automatically interrogates the nearest Reservisor. The TWA Reservisor drums will not keep actual inventory count but merely store information on space availability. When space is sold, the agent operates a small lever on his agent set which automatically transmits details of the sale, via teletype, to TWA's central reservations bureau (Kansas City for domestic flights, New York for overseas).

The TWA central reservations bureau will use manual posting techniques to keep tab of the inventory for each flight. However, Teleregister is working out a program which will enable TWA later to add a large magnetic Reservisor at Kansas City and New York to perform this inventory count task automatically.

When available space on a specific flight is exhausted, the central reservations bureau will send a teletype message to the three district Reservisor centers. The message comes out on punched tape which, when inserted in a special translator, automatically updates the space-availability information in the Reservisor for that particular flight to show no space available.

Both the National and TWA Reservisor drums will store information on flight status (whether flight is on time, how late, or canceled) and on general weather conditions at each city on the line. Agents will be able to obtain instantly such information by interrogating the drum from their agent set.

Copter Traffic Control To Be Studied by CAA

Washington—Civil Aeronautics Administration is negotiating with the Navy to obtain a Sikorsky S-58 helicopter to study air traffic-control problems associated with inter-city helicopter operations.

Acting Administrator James Pyle said the CAA wants to make a first-hand study of navigational aids in helicopter flights and has been working with the Navy on plans involving S-58s equipped with automatic stabilization gear and other equipment for instrument flight.

The CAA hopes that tests with the S-58 will determine whether helicopter service will fit into present airways and communications systems. The agency

PRESSURIZE ELECTRONIC EQUIPMENT

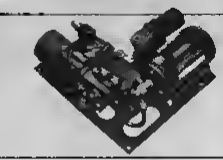
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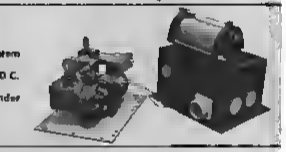
MODEL E/AP-100 TYPE 202

- Maintains system pressure of 25 PSIA minimum
- Motor is .03 HP—12,000 RPM., 200 V, 3 ph., 400 cy.
- Current draw is .7 amperes/phase maximum under normal operating conditions
- Unit operates continuously
- Weight is 4¾ lbs. maximum



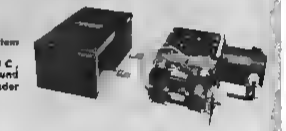
MODEL E/AP-150 TYPE 205

- Operating pressure switch maintains system pressure of 17 PSIA
- Motor is 1/25 HP 7,500 R.P.M. 27 volts D.C. — 100%
- Current draw is 2.0 amperes maximum under normal operating conditions
- Life is 600 operating hours
- Weight is 8 lbs. maximum



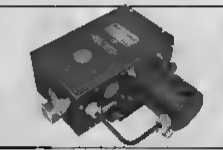
MODEL E/AP-1500 TYPE 203

- Operating pressure switch maintains system pressure of 30 PSIA
- Motor is 1/15 HP nominal 24-28 volts D.C., 5,000 R.P.M. continuous duty shunt wound
- Current draw is 3.4 amperes maximum under normal operating conditions
- Life is 500 operating hours
- Weight is 12 lbs. maximum



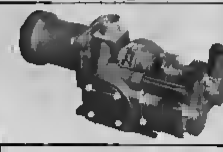
MODEL E/AP-2400 TYPE 201B

- Maintains system pressure at 31 PSIA
- Motor is 1/18 HP. 24-28 volts D.C., 5,000 R.P.M. continuous duty
- Current draw is 5.5 amperes maximum
- Life is 600 operating hours
- Weight is 10-3/4 lbs. maximum



MODEL E/AP-3600 TYPE 200

- Minimum system pressure of 31 PSIA
- Motor is 1/7 HP, 18,000 RPM { 500 V, 600 cy, 3 ph } continuous operation { 24-28 V D.C. }
- Current draw is { 1.3 amp/phase } { 7.1 on D.C. } amperes maximum under normal operating conditions
- Life is 1,000 operating hours
- Weight is 8-1/2 lb. maximum



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Bullet Nose

Bullet-nosed propeller spinners which United Air Lines is installing on Douglas DC-7s to add three miles an hour to present 365 mph cruising speed. All of the company's 26 DC-7s will have the new Hamilton Standard spinners by December. In addition to the increase in speed, the aluminum spinners will also insulate propeller oil against congealment during cold weather and improve flow of air to engine cylinders.

also intends to study heliport requirements and to work out standards for pilots seeking instrument flight ratings for helicopters.

Pyle predicted that multi-engine helicopters would "provide a new operational freedom while maintaining even higher safety standards than are possible today."

Animal Hostel Planned For Idlewild Airport

New York—Construction of a $180,000 facility for transient animals, with rates ranging from $4 a day for lions and tigers to five cents a day for canaries will begin this fall at New York International Airport.

The Port of New York Authority has announced the signing of a lease with the American Society for the Prevention of Cruelty to Animals covering the 1 4 acre site on which ASPCA will erect the shelter, said to be the first of its kind in this country.

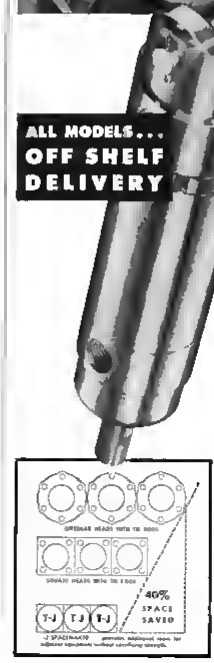
The plush hostel for this special class of international air traveler will be equipped with 36 individual tile kennels with outdoor runs, paddocks, exercise cages, and medical facilities including ambulance service. Apes or monkeys may put up at the shelter for $2 50 a day single or at reduced rates if traveling in groups.

Last year over 100,000 animals were handled at Idlewild, including pets, race horses, elephants, and monkeys used in polio vaccine tests.

Arctic Cargo Carrier Depends On T-J Spacemaker CYLINDERS



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Differential axle loading through T-J Spacemaker Air Cylinders forms a controlled walking beam in this Tera-cruiser, designed and produced for the Army Ordnance Corps by the Four Wheel Drive Co., Clintonville, Wis.

Weight of cylinders was important factor in choosing T-J Spacemakers, which reduce weight while providing same displacement and extra high safety factor. Fast delivery and space-saving features also favored T-J. Exclusive with T-J are new Super Cushion Flexible Seals for Air (to 200 P.S.I.), and New Self-Aligning Mester Cushion for Oil (to 750 P.S.I.). Hard chrome plated bodies and piston rods are standard, at no extra cost. Wide range of styles, capacities, 64,000 combinations *off the shelf!* Write for bulletin SM-155-3. The Tomkins-Johnson Co., Jackson, Mich.

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The HOK-1 is a general utility, high performance helicopter manufactured by Kaman Aircraft Corporation, Bloomfield, Connecticut.

A weight-cost formula developed by Kaman engineers and used in combination with Titanium has resulted in substantial savings in the production of the HOK-1.

In the photo at left, a Kaman assembler is shown fastening sections of the firewall between pilot and engine compartments. These sections are fabricated from .016 gage Republic Titanium, Type RS-70 Annealed. This type has good forming qualities and a minimum tensile strength of 80,000 psi.

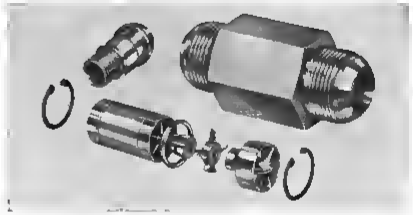
The high strength and lightweight advantages of Republic Titanium are adding range, speed and maneuverability to both military and commercial aircraft. These characteristics—plus Titanium's extremely high resistance to most forms of corrosion—are also being used to advantage in non-military applications such as, chemical equipment, heat exchangers, dehydration trays, anodizing racks and food-processing equipment.

Republic, world's largest producer of alloy and stainless steels, and pioneer in high strength-to-weight metals, offers you years of experience gained through helping hundreds of manufacturers design and redesign their products to get more strength with less weight at less cost.

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ALLOY STEELS are vital in meeting today's demands for speed and light weight. They provide the highest strength values—plus an exceptionally high strength-to-weight ratio that permits transmission of thousands of horsepower through tough, strong gears and shafts free from excess weight. Republic will help you apply these fine steels to insure safety, extend equipment life and reduce maintenance and replacement costs.

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ENDURO STAINLESS STEEL, because of its resistance to corrosion, is used for bearings, housing and rotor in this turbine flow meter made by Fischer & Porter Co., Hatboro, Pa. This delicate instrument measures precise flow rate in testing jet fuels. The slightest trace of corrosion would impair its accuracy. ENDURO Stainless Steel helps maintain an accuracy of ±1/4%. Republic produces ENDURO in all commercial forms.



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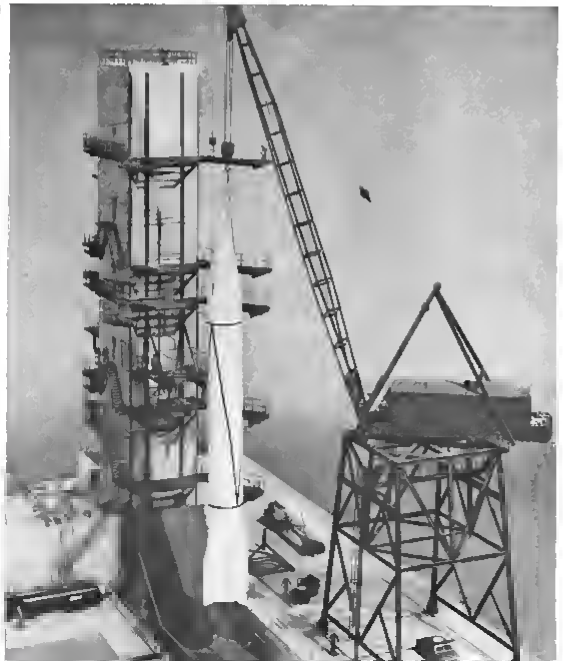


CONTROL BLOCKHOUSE at Patrick AFB designed by Daniel, Mann, Johnson and Mendenhall of Los Angeles showing vertical escape hatch and four periscope casings. Thick cushion of sand will cover the concrete to absorb shock.

Architect-Engineers Build for Aviation

By Irving Stone

MODEL OF ROCKET test stand designed by Ralph M. Parsons Co. of Los Angeles for Redstone Arsenal



Los Angeles—Architect-engineering firms are taking on a key role in aviation. Today, some architect-engineering companies have become specialists participating in programs leading to development of weapon systems and creation of associated facilities.

The extensive work they now are performing generally is beyond the scope of the plane, missile or engine builder. A new talent is being introduced into the ever-broadening aeronautical picture.

It wasn't so long ago that the prime aeronautical vehicle—the airplane—required only a factory to build it and an airstrip from which to fly it. But now the airplane has become a sophisticated vehicle requiring special runways, hangars and fueling facilities. Added to this is the airplane's close relative, the missile, which has introduced new complexity in production, handling, test and firing.

And nudging its way into the weapon system picture is the nuclear-powered aircraft, which will bring with it a complex of facilities not previously attempted for basing, servicing and maintenance.

Specialized Team

These relatively new developments have dictated the high utilization of the architect-engineering firm in aeronautical projects which may range from initial studies of a contemplated vast undertaking to the actual design of the various facilities to make the project a reality.

To carry out its job, the architect-engineering organization draws on its specialized team with engineering knowledge encompassing a wide cross-section of factors, such as nuclear radiation, blast and explosion criteria, fuel processing, sound attenuation, controls, instrumentation and numerous other areas.

A management talent has been developed to coordinate application of this knowledge and to move fast to meet the emergencies of any accelerated or crash program.

One of the prime jobs which sometimes has been delegated to the architect-engineer is the feasibility study, the first step in the development of perhaps a weapon system or a related item. Some of these feasibility studies come to the architect-engineer from the using agency, some from the prime contractor, such as the airframe or engine builder, which may delegate this work to supplement its own capability. This may be limited by considerations of manpower and time involved.

In effect, the feasibility study is an analysis of the total technical knowledge available on a given subject to determine whether this information can be applied practically to make possible the introduction of a workable system. For example, the study may be concerned with the possibilities of developing the process and facilities for an unusual fuel around which a new breed of powerplant could be developed.

Service Organization

The architect-engineer with its team of specialists then acts as a service organization and may find it necessary to consult with numerous scientific agencies—even those having a remote relationship to the study problem.

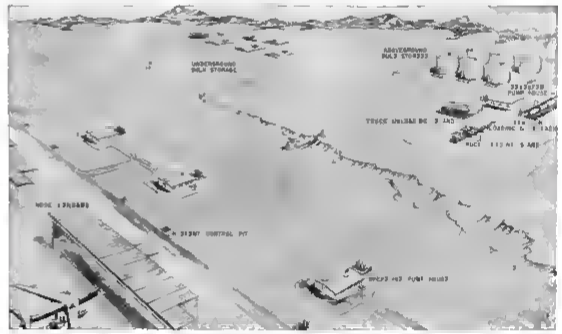
When the feasibility study determines the practicality of a concept leading to the initiation of a new system, process or its components, the architect-engineer next may be called upon to translate the theory of the study into a program leading to the ultimate development of operational hardware. This covers additional study and may be concerned with what new laboratory facilities will be required, manpower demands, and time involved.

If, after this study, the using agency or the prime contractor decides that it is practical to go ahead with the project, the architect-engineer will design the laboratory facilities, may even operate them initially and train the using agency's or prime contractor's personnel to take over.

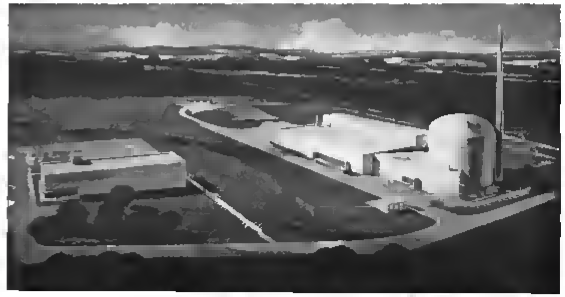
Research and development work in these initial facilities may lead to the



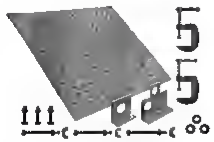
FOUNDATION for flame deflector of DMJM-designed missile test stand at Patrick AFB. Piles will be part of test stand foundation.



TYPICAL HIGH-SPEED aircraft fueling system designed by Parsons for jet age airports.



ARTIST'S VERSION of Parson-designed nuclear reactor and engineering test facility for Wright Air Development Center. "Cold" lab for setup of components and systems is at left. At right is reactor and radiation cells. Center is "hot" lab where exposed systems are analyzed.



Wanted: **Design Development and Production Engineers**

HONEYWELL'S advanced development programs and associated production require creative and imaginative thinking.

The "Erector Set" you see on the opposite page is an example of the flexibility and imagination encouraged and rewarded at Honeywell's Aeronautical Division.

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MINNEAPOLIS **Honeywell**

AERONAUTICAL DIVISION



DRAWING OF DMJM-designed personnel airlock for dust control in North American Aviation's autonavigation building

assignment for the architect-engineer to design additional facilities for fabrication of prototype articles and their testing.

A final round of facilities may be designed for production and test.

One of the prominent architect-engineering organizations associated with this specialized field of work is Ralph M. Parsons Co., headquartered in Los Angeles. Parsons is engaged in advanced aviation projects which draw heavily on the specialized skills of the architect-engineer.

These projects include the Air Force and Navy nuclear-powered aircraft programs, intermediate-range ballistic missile program, high energy fuel development, and design of facilities for nuclear engine development at the National Reactor Test Station in Idaho.

WADC Facility

One of the test installations recently designed by Parsons is the nuclear reactor and engineering facility at Wright-Patterson AFB, to provide Wright Air Development Center with the means for investigating materials, components and systems for the nuclear programs (AW Aug. 6, p. 173).

The huge integrated high-thrust rocket test station at Edwards AFB (AW Aug. 6, p. 143) also was designed by Parsons. This facility includes towering test stands, control stations, instrumentation, propellant storage and handling provisions, hazardous-waste disposal systems, laboratories and shops.

Underground bulk fuel storage facilities have been designed by Parsons for Strategic Air Command bases throughout the world.

An early (1948) notable accomplishment of Parsons was the design of technical facilities at Los Alamos, N. M., for the development of nuclear weapons.

During the past ten years, Parsons has performed architect-engineering services for facilities having a total constructional value in excess of $2 billion. A substantial share of this has been design services associated with aviation projects.

Another organization whose work points up the important relationship of the architect-engineer to today's aeronautical activity is Daniel, Mann, Johnson and Mendenhall, also headquartered in Los Angeles.

DMJM has been associated with the intercontinental ballistic missile program for Convair, North American Aviation, the Air Force and the Corps of Engineers.

Static Test

For the San Diego area, the company has designed a stand to static test the entire missile and another stand to test missile components in conjunction with engine operation. One of the big problems was that of "uplift"—the stands had to be designed to take the high thrust of the rocket engines without impairment of structural stability. Forces imposed by engine gimballing also posed severe structural problems. And the stands had to be designed to resist earthquake forces which might occur during test. Each stand requires 30,000 gal. of water per minute to cool the 1-in.-thick-plate flame deflectors which would otherwise melt in a matter of seconds.

Associated with the test stands is a control blockhouse which has been built to resist the high blast of an explosion, yet is sufficiently close to the stand to avoid loss of accuracy in instrumentation.

Also designed for Convair at San Diego is a mezzanine covering more than 100,000 sq. ft., for use with ICBM activities.

Hurricane Forces

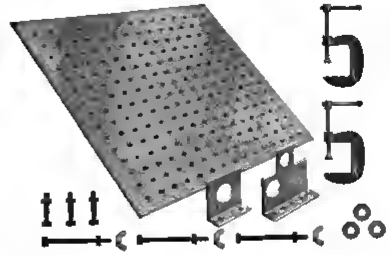
For construction at Air Force Missile Test Center, Patrick AFB, four combination static and launching test stand complexes have been designed by DMJM for Convair's use.

Two of these stands were designed under Corps of Engineers supervision, and the other two were under subcontract to Convair.

Uplift thrust for static test stand operation had to be resisted by pile construction because of sandy terrain. Stands also had to be designed to resist hurricane forces.

Associated with the combination stands are provisions for elevating and fueling the missile.

Control blockhouses, about 60 ft. in diameter with walls 10-20 ft. thick, are designed to resist explosions of missiles which are fired and aborted in flight, resulting in a near-miss or direct hit on the blockhouse. A thick cushion of sand over the concrete structure is



Jigs, made from miscellaneous hardware like this, enable Honeywell Aero technicians to build temporary tooling in minutes at one-twentieth the cost of standard type fixtures. These so-called "erector set" jigs are used for short-run items, test fixtures and preliminary tooling. The idea, developed in the production department, is typical of the flexibility and imagination encouraged and rewarded at Honeywell Aero.

AERONAUTICAL DIVISION, MINNEAPOLIS-HONEYWELL

New

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Fastener Can be Power Driven

TIGHTER



...YET REMOVED WITHOUT DIFFICULTY

American's new TORQ-SET fastener for aircraft is the only one of its kind with a wrenching recess which allows power driving at extremely high torque, yet it can be removed without difficulty.

This is because TORQ-SET's recess has driving walls that form a direct axis for driving. And TORQ-SET, supplied in high strength alloy steels (including the newer heat-resistant types) — is designed to permit extremely high wrenchability without burring or distortion. On-the-job performance shows that the need for head refinishing is eliminated.

In addition to its exclusive recess design, TORQ-SET is produced by American as a completely forged product . . . affording the benefits of the superior physical properties of forging and making it possible to furnish the unlimited quantities required by mass producers.

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used to absorb shock. Observation from the blockhouse is by periscope or closed circuit TV.

Also being designed for Patrick is a liquid oxygen (lox) manufacturing facility to support all of the missile programs at the base. The design allows for ultimately doubling the initial production of lox.

Substantial Increase

For North American Aviation's use at Santa Susana an even larger lox plant has been designed. This, coupled with other lox plants for the ICBM program, will increase the total lox manufacturing capability of the country by a substantial amount. All these lox facilities unusually large by commercial standards, involve out-size equipment and massive foundations.

A multiplicity of stands has been designed by DMJM for NAA's Rocketdyne Division at Santa Susana to test rocket engines for the ICBM and IRBM programs, as well as to serve as a facility for development of future engines. One of the test stands is designed to incorporate a vacuum chamber to simulate altitude conditions in connection with engine operation (AW, Apr. 23, p. 37).

The autonavigation building at NAA's Autonetics Division, Downey, Calif., is another example of design specialization demanded of the architect-engineer to support the exacting requirements in the development, engineering and manufacture of automatic navigation systems. A large portion of the building has been designed by DMJM for "dust-free" conditions—dust count of 10,000 particles, or less, 0.3 micron in size, per cubic foot of air. (This compares with from 12 to 75 million particles of dust, one micron in size, per cubic foot of normal air.) Temperature has to be controlled to plus or minus ½ deg. F, and humidity to less than 45%. There are special personnel access airlocks and workers use lint-free smocks and headpieces.

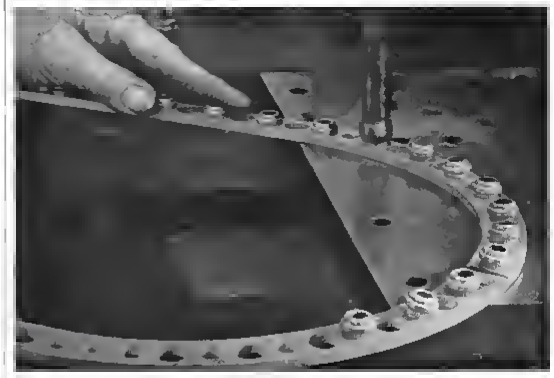
Flexibility

Another highlight of the building is the flexibility designed into it with regard to area rearrangement and special utilities to take care of modification to meet future developments in production. Total area involved is about 230,000 sq. ft. in the initial plan, with expansion possible to double this area.

One of the specialized jobs DMJM is performing for the Air Force relates to overseas air bases. Already this architect-engineering firm has planned and designed or rehabilitated more than 30 major bases in the United Kingdom, Europe, Pacific area and the Far East.

Installation highlights have been

FASTENER PROBLEM



SIMPLIFIED FASTENING METHOD

developed for Douglas' fuel-tank access doors

A design for fuel-tank access doors, in use by Douglas Aircraft Company on DC-6 and DC-7 airliners, involves a rubber coated assembly of fasteners in gasket-type clamping rings. Douglas engineers required a threaded, self-locking fastener that would retain the advantages of the base sealing method while providing a practical, safe method of attachment.

ESNA supplied the solution in the form of an improved self-retaining splined-shank type nut. Developed specifically for such applications, the ND2398 offers these design features. (1) A chamfered pilot on the shank to center the nut and assure equal seating of the splines around the installation hole. (2) A chip relief groove to allow actual broaching of the hole and thereby minimize hoop stress in the work, it also insures proper seating of the part. (3) Minimum flange diameter for close clearance applications. (4) A counterbore to provide thread length to accommodate "AN" bolts.

The spline nuts are simply pressed into drilled holes and the entire assembly coated with rubber. (The high reusability assured by nylon insert ELASTIC STOP nuts is, of course, essential to this type of access door application.) Douglas engineers report significant time and labor savings in fabrication and maintenance.



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High-strength Alcoa forged magnesium nosewheel saves weight in the Douglas DC-7C

Now Alcoa forges lighter, stronger wheels

for bigger, faster planes

Alcoa's mammoth forging facilities can now provide the aviation industry with its biggest . . . or smallest . . . forged magnesium wheels. The switch to forged wheels has accelerated to the point where one out of every three wheels is now a forging.

Why the switch?

Higher landing and take-off speeds, heavier loads, tubeless tires, higher tire pressures all demanded the ultimate in wheel strength.

Like a chain, a wheel can be no stronger than its weakest part. With forged magnesium wheels, each segment is subjected to the same forces as it rolls. Plane designers get the required high strength, uniform grain structure, high fatigue strength and less weight.

Another consideration is the need for bigger brakes.

Well-designed forgings do not require large fillets or ribs to provide more strength at the critical bead radius. This means maximum area is available for full-sized drums.

Alcoa® has worked closely with aircraft designers and wheel builders to provide the right alloys, forging methods and forging equipment. The vast knowledge of light metallurgy available at Alcoa helps speed wheels from design to final production. You can learn more about what Alcoa can do to help you by writing ALUMINUM COMPANY OF AMERICA, 1800-K Alcoa Building, Pittsburgh 19, Pa.

ALWAYS FASTEN ALUMINUM WITH ALCOA ALUMINUM FASTENERS



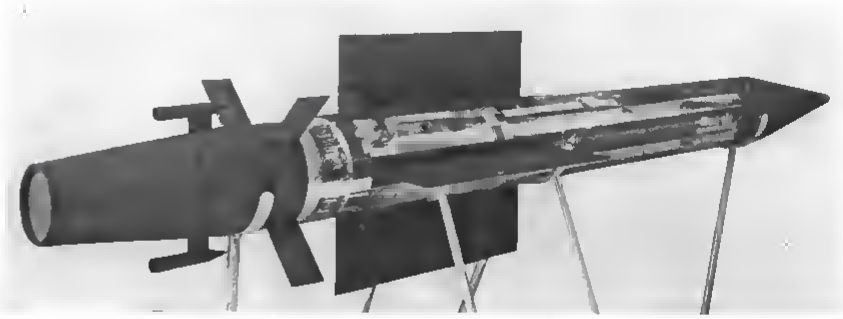
THE ALCOA HOUR

Your Guide to the Best in Aluminum Value

concerned with special underground fuel storage systems, high speed refueling equipment, maintenance shops, rocket storage facilities, lengthened and strengthened runways, housing, recreational and educational facilities. The overall embodiment of these facilities comprise a community specifically slanted to meet Air Force needs.

Consultation services also are supplied by DMJM to Hq, USAF. Contact is Asst. Chief of Staff—Installations. The services comprise the furnishing of definitive drawings covering standard design criteria for all Air Force general supporting structures ranging from such units as sentry boxes to hangars which would accommodate the B-52. This is a continuing program of services which has been underway for three years. The firm was the first architect-engineering organization retained by the AF to furnish consulting services for this purpose.

Formed ten years ago, DMJM has handled projects, in the past six years, having a total construction cost of about $1.7 billion. About 40% of this has been in conjunction with aviation projects, the company reports.



Bristol Control Test Vehicle

First details of this elderly Bristol control test vehicle were shown at the SBAC display at Farnborough. Vehicle is rocket boosted and after separation coasts to termination. Maximum speed is over 2,000 fps., peak acceleration a 35 G. Wings of very low aspect ratio are fixed and have truncated double wedge airfoil sections. Tail surfaces are similar, but are movable.

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Design Almost Complete on Electra as Fabrication Begins

Fabrication work begins this week on the first Lockheed Electra turboprop transport. Design is reported to be 80% complete and payload figures have been upped 20% from early estimates to 21,638 lb., with an increase of only 3,000 lb. in maximum takeoff gross weight.

Fuselage and wing dimensions have grown since release of preliminary design data. Length has been increased by 3 ft. 2½ in. and wing span has increased by 4 ft. Height of the tail has decreased 1 ft. 11 in. Dorsal fairing of the redesigned fin has been extended forward for greater strength and smoother flow.

Propeller Choice

Altitude capacity of the 66 to 91 passenger liner is down from early expectations of cruising altitudes up to 30,000 ft. The presently specified service ceiling is 27,000 ft. at a gross weight of 100,000 lb.

The Electra's 19% payload-to-maximum takeoff gross weight ratio is the best of American transports now in design or operation. Lockheed feels that this combined with the good airport performance of turboprops and a 354 kt. top cruising speed assures the airplane of a place in the short and medium haul market which handles about 75% of domestic business.

Powerplant is the Allison Model 501 D-13 rated at 3,750 eshp. for takeoff and 2,660 eshp. for cruise at 20,000 ft. Four-bladed, 13 ft. 6 in. propellers are specified with anti-icing, full feathering and reversible pitch. Choice of Aeroproducts or Hamilton Standard propellers will be offered. Performance stretch built into the airframe will permit the specification of 5,500 hp. engines when these become available. They are expected to boost cruising speed to 430 kt. Conversion to 4,050 hp. Allison Model 501 D-15 engines is already being engineered.

Flight Controls

Flight controls are hydraulically boosted by two separate electrically driven systems backed up by a manual system.

Three single point maintenance centers for the hydraulic, electrical and air conditioning systems are located in the lower right fuselage. The single point under wing fueling center is also located on the right side to keep all maintenance operations from interfering with passenger loading. Four engine driven 60 kva ac generators produce 208/120 volt, three-phase 400 cycle constant frequency current. Fluorescent lighting is used in the cabin.

Separate air conditioning systems are used for the cockpit and the cabin. The latter is radiant heated by three separately controlled radiating sections in the floor and four in the walls. Ventilation is claimed to be draft-free.

Lockheed now has a force of over 500 doing the production engineering on the Electra. A total of more than 1.25 million engineering hours have all ready been spent on the job.

New Electra Specifications

Dimensions	
Fuselage length	104 ft. 6.5 in.
Fuselage inside diameter	128 in.
Height over tail	32 ft., 1 in.
Wing span	99 ft.
Aspect ratio	7.5
Capacities	
Lower compartment cargo volume	511 cu. ft.
Fuel capacity	5360 gals.
Weights	
Maximum gross takeoff weight	113,000 lbs.
Maximum landing weight	95,650 lbs.
Maximum zero fuel weight	80,910 lbs.
Weight empty	56,000 lbs.
Maximum payload (Weight Limit)	21,638 lbs.
Payload (Custom Interior)	18,000 lbs.
Performance	
Takeoff distance over 50-foot obstacle (sea level)	4100 ft. @ 97,500 lbs. or 5800 ft. @ 113,000 lbs.
Landing distance at maximum landing weight (without reversing props)	5400 ft.
Maximum rate of climb at normal rated power (sea level)	1670 ft. per min. @ 113,000 lbs. or 2400 ft. per min. @ 92,000 lbs.
Stalling speed at maximum landing weight with landing flaps	93 knots
Maximum level flight speed	389 knots @ 12,000 ft.
Maximum cruise speed, landing weight with space limit payload	354 knots @ 20,000 ft.
Maximum range, no reserve	3680 miles (3200 naut. mi.)
Maximum range, 2.5 hrs. reserve	2740 mi. (2380 naut. mi.)
Service ceiling	27,000 ft. @ 100,000 lbs.

Lockheed Develops Missile Data System

Van Nuys, Calif.—Details of a new time saving technique for recording and analyzing guided missile flight data was revealed to NATO's Advisory Group for Aeronautical Research and Development (AGARD) at a meeting in Venice, Italy.

Developed by Lockheed's Missile System Division, the system "processes in only two days a mass of flight information that formerly took scores of engineers and technicians weeks to analyze, also eliminates to a great extent human error that crept into manual methods."

A prototype of the system has been used by the Missile System Division for about two years.

It is being applied to flights of Lockheed's hypersonic ballistic missiles X-7 supersonic ramjet test vehicle, and other missiles.

The system is in some respects similar to the telemetering and data reduction systems generally used in missile testing, but technical shortcuts have been introduced which cut tremendously the time between flight and complete analysis.

The automatic data reduction machine developed by Lockheed accurately classifies as many as 100 readings per second. Readings are fed into a converter which controls a standard accounting-type card punching machine. The punched cards are fed into a high speed electronic computer, then into an automatic plotting machine adapted to produce a graph of the missile's performance for study.

Lockheed reports that numerous U. S. missile manufacturers are incorporating the basic principles of the technique into their systems.



SKETCH OF EJECTION seat arrangement shows: 1. Skip flow generator modifies airflow pattern to reduce decelerative "G" loads and airblast on occupant. 2. Side fins provide yaw stability. 3. Horizontal vanes limit roll velocity for improved flight dynamics. 4. Lateral head supports relieve neck loads. 5. Feet are automatically retracted and held. 6. Guards prevent leg spreading under airloads. 7. Porous webbing restrains arms. 8. Oxygen and communication equipment are designed to withstand airblast.

Ejection Seat Developed for Mach 3 After ARDC Decides on Capsules

Los Angeles—A supersonic escape ejection seat has been developed which is designed to permit safe escape limits exceeding 800 kts. at sea level and Mach 3 at altitude. The development comes in the face of a decision by Air Research and Development Command to require escape capsules incorporating protective and survival devices for all new aircraft with performance exceeding 600 knots IAS and 50,000 ft. altitude.

The ARDC decision was made known at the Air Force-industry conference on emergency escape from high performance aircraft, Santa Barbara, Calif., by Capt. John W. Goodrich, directorate of research, Wright Air Development Center.

Full-Scale Tests

Details of the ejection seat for supersonic escape, a development of Lockheed Aircraft Corp., were outlined at the same meeting by Lockheed's P. A. Colman and L. H. Culver. The conference, the 24th of its kind, was sponsored by USAF Directorate of Flight Safety Research.

Wind tunnel and free flight model tests of the seat reportedly have been completed. Full-scale rocket sled tests are scheduled for the fall of this year and the early part of 1957, release of detail production design for early next year and first production units in the latter half of next year.

Minimum Modification

Known as the Model D, the supersonic-escape ejection seat has been designed for retrofitting to present aircraft with minimum modification to plane and cockpit. The new seat design, a downward-ejection configuration, incorporates many ingenious features:

- **A skip-flow generator** extends from between the pilot's feet to surround him, in effect, with an atmospheric capsule.

The skip-flow generator consists of a plate at the end of an actuated rod. This plate presented to the airstream at a slightly up-tilted angle, modifies the airflow pattern to reduce decelerative G loads and airblast on the occupant of the seat.

Design deceleration values are less than recognized conservative limits for body damage.

Schlieren studies at Mach 2 show the faired body flow deflection obtained with skip-flow, in contrast to the drag-producing disturbances obtained with the conventional blunt seat.

Chest pressure with skip-flow is reported to be one quarter that resulting with the conventional seat and no skip-flow.

A characteristic of the skip-flow generator is its increased drag reduction with increase in Mach number.

- **Side fins in conjunction** with the forward center of gravity resulting from extension of skip-flow generator provide directional stability. Fins extend below bottom of seat.
- **Horizontal vanes,** which are hinged at approximately the middle of the fins, extend up to limit roll velocity for improved flight dynamics.
- **Pitch stability** and trim in normal ejection attitude are improved by forward location of center of gravity and aerodynamic effects of extended skip-flow generator. Restoring pitching moments extend over a large-angle range, thus accepting substantial launching perturbations.
- **Lateral head supports,** which clamp the helmet on each side, relieve the effect of airloads on the crew member's neck.
- **Normal attachment** and release of foot is accomplished with a simple foot motion. During ejection, feet are pulled into position and positively held until time of separation of pilot from seat.
- **Guards** pivot forward along side knees and prevent legs from spreading under airloads.
- **Restraining webbing** is used alongside pilot's arms to prevent their outward motion, while allowing airloads to counteract inertia forces.
- **Bulky oxygen** and communication equipment has been modified to withstand airblast.

Stable Seat

In a high speed ejection, the roll vanes, skip-flow generator, and leg guards are positioned prior to separation from the plane. Deceleration and descent are made in a stable seat and upon attaining proper combination of altitude and indicated airspeed the parachute is deployed from the seat. Seat separates from crew member immediately after opening shock, allowing the crew member to descend to ground by chute.

At low altitude with an indicated airspeed of less than 300 kts., chute deploys immediately upon ejection. Seat is released immediately after opening shock, and crew member descends by chute.



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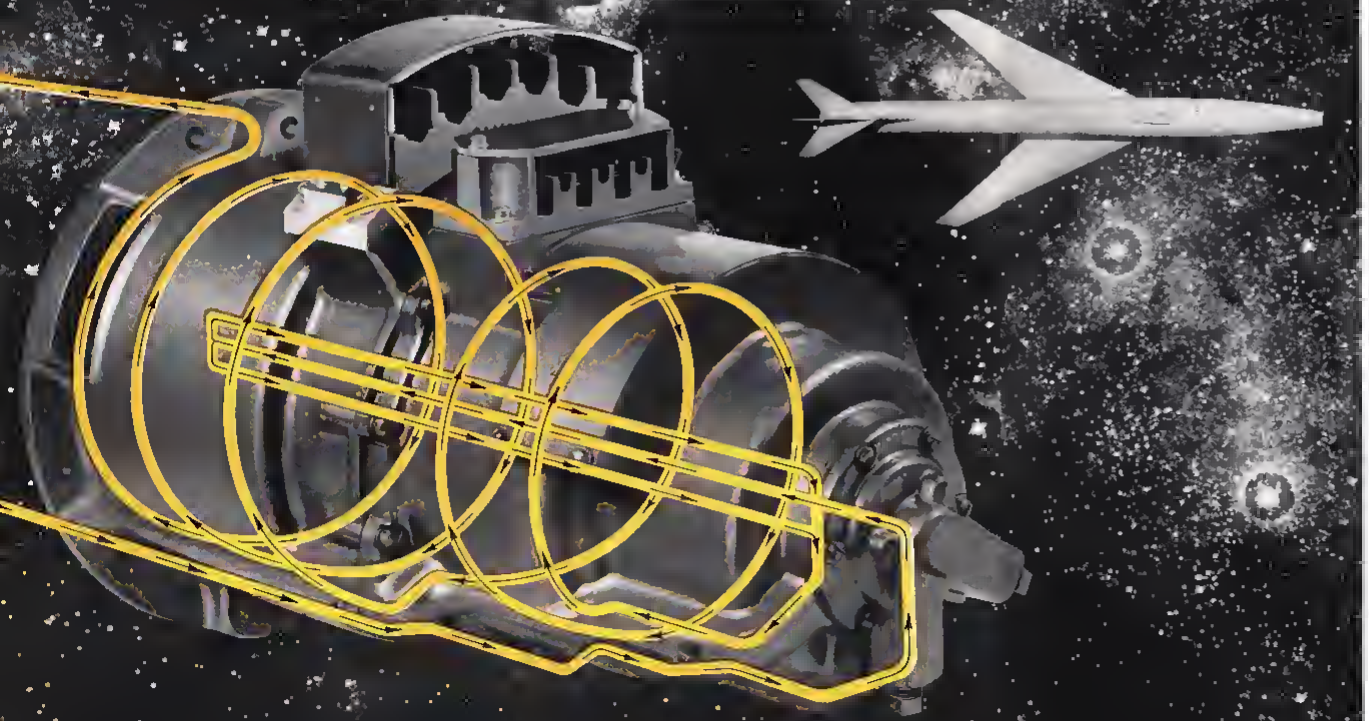
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TOMORROW'S AIRCRAFT: *One step closer*

Now!
Power without problems



This revolutionary a-c generator is cooled and lubricated by engine oil . . . has no brushes, slip rings, commutator or grease-lubricated bearings . . . gives superior performance.

Westinghouse research in the field of semiconductors produced the high-temperature silicon diodes that are the key to the operation of this new generator. A-c power generated in the exciter armature is fed into the silicon rectifiers mounted on the generator shaft. The resulting d-c output supplies the main rotating d-c field.

Without brushes, aviation gas turbine engine oil can cool and lubricate the generator. Oil is pumped through the generator shaft, through tubes in the frame casting, and is used in the hydraulic constant-speed drive. All heat picked up by the oil is dissipated in the engine oil cooler. The generator operates safely with engine oil at temperatures up to 300 degrees Fahrenheit. All the usual generator trouble spots are eliminated—no brushes or commutating parts to wear, bearing lubricant is continuously replaced.

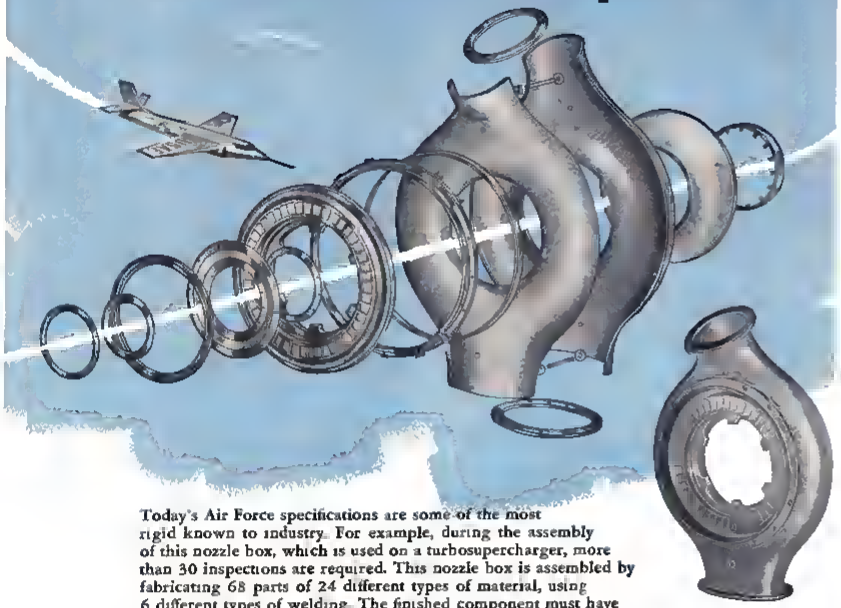
This is the first generator that is completely integrated with its drive, with the engine oil cooling system and with the balance of the electrical system. It is completely enclosed, there are no air tubes or ducts to occupy space and clutter up the airframe, all external oil seals are static and there is no overboard drainage of oil. No additional plumbing is required because the extension of the engine oil lubricating system is all internal. Now—aircraft altitude and speed will no longer be limited by the electrical system—a big step toward helping you bring tomorrow's aircraft . . . one step closer. J-91024

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Airborne Electronics • Airport Lighting • Ground Electronics
Aircraft Electrical Systems and Motors

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Today's Air Force specifications are some of the most rigid known to industry. For example, during the assembly of this nozzle box, which is used on a turbosupercharger, more than 30 inspections are required. This nozzle box is assembled by fabricating 68 parts of 24 different types of material, using 6 different types of welding. The finished component must have the same tensile strength and original characteristics as the parent metal.

Amweld, with its special ability to form, weld, size and machine rings, circular weldments and components, is geared to the manufacture of such complex parts.

Do you have a component assembly problem? If so, contact the Industriel Products Division of The American Welding & Manufacturing Co. today! They will be pleased to help you.

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AMERICAN WELDING



MOBILE GENEST muffler attached to USAF Lockheed T-33 at Fuerstenfeldbruck is made of perforated sheet iron, lined with perforated sheet iron and narrow meshed wire gauze.

German Jet Muffler Developed

Bonn—The first German-made muffler of jet aircraft blast has been developed by the firm Werner Genest, Stuttgart-Degerloch. It recently was demonstrated before representatives of the German Defense Ministry, the U. S., British and Dutch air forces and several German and foreign aircraft firms.

Demonstration took place in Fuerstenfeldbruck with the assistance of the U. S. Air Force which made available two Lockheed T-33 jet trainers.

The Genest silencer, named "Jouny," is mobile and can be used to muffle the din from planes just prior to takeoff and during preflight and postflight inspection. It muffles low frequency sound from the combustion chambers and aerodynamic phenomena, but not air intake high frequency sound.

Silencer is constructed in form of a diffuser with the inner section widening from 0.6 to 1.5 m. Total length is 7.5 m., including a transition cone; largest outward diameter is 2.2 m. The silencer is made of normal perforated sheet iron, the inner channel is covered with perforated sheet iron of 1 mm. and narrow meshed wire gauze. Total weight is about 7 tons.

The dimensions were kept as small as possible to aid mobility.

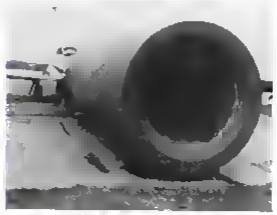
Turbulence agglomerations are prevented by the installation of grids in the muffler head. The muffler silences the extremely low frequencies (40-400 Hz) at a length of only 6 m. effectively and it secures an average soundproofing of 25 dB, thus reducing the exhaust noise to one fifth of its original strength.

Convair Starts Work On $2 Million Facility

Ft Worth, Tex.—Work on a $2 million high-altitude test facility will begin here this month at the Convair Division of General Dynamics Corp.

Three test cells of varied sizes will simulate altitudes up to 100,000 ft. and temperatures from −100 to plus 500 degrees fahrenheit. The facility will include a test building housing the cells, an instrument corridor and a control room and an equipment building housing compressors and heat, refrigeration and auxiliary equipment. Walls of both buildings will be reinforced steel plate with 12-in. thick insulation.

Completion of the buildings is expected in 1957. Control room design, utility services and site development are being done by the Ft. Worth architectural firm of Wyatt C. Hedrick. Detail design and construction of mechanical systems and test chambers will be done by Arthur E. Magher Co. Inc., of New York.



SILENCER is in form of diffuser with inner section widening from 0.6 to 1.5 m.

Troop Carriers to Make Airdrop for Antarctica

Sixty-Third Troop Carrier Wing will carry out Air Force airdrop of buildings, tractors, equipment and supplies to the International Geophysical Year base in Antarctica. Eight specially equipped Douglas C-124 Globemasters will leave Donaldson AFB this month and next for New Zealand where airlift operation will be based. First missions to Navy icestrip at McMurdo Sound will begin about Oct. 15, and four C-124s will be based there.

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the TV camera that can take it *it's RUGGEDIZED*

Unique in closed circuit TV, this rugged, remote control camera manufactured by GPL packs into six pounds the sniper rugged construction that enables it to operate efficiently in extreme environments. It is the only camera to have performed successfully under flight conditions with forces exceeding 15 G's in each of its three axes. Noise levels as high as 175 decibels and altitudes over 70,000 feet do not affect picture detail. Camera can withstand temperatures of minus 55 C to plus 60 C. Humidity levels of 100% and extremely high wind velocities. Though not hermetically sealed, it is spray proof — [illegible] operating for 800 hours in an icing tunnel the camera showed no sign of damage or operating failure.

Including motors for remote control of its and focus, the camera is only 7" long without the lens 5⅜" high 3¼" thick—small enough to fit in almost anywhere. It operates on a 525 line system 60 fields interlaced 550-line resolution. No external shock mount is required. All controls can be handled from a remote location. Power requirements are minimum.

This new TV camera results from special aviation test needs of Lockheed Aircraft Corporation. Because of its standing in the TV field, General Precision Laboratory was chosen by Lockheed to produce the small size, remote focus camera it had developed. In it, ruggedized components are combined in a unique design that isolates critical vidicon tube and video circuit areas from external vibration. GPL has production engineered it for widest application in heavy construction, engineering research, automotive testing and many other industrial and military operations as well as in aviation. Write for further information.

GPL **General Precision Laboratory Incorporated**
Pleasantville, New York
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HONEST JOHN leaving lightweight launcher which can be moved by helicopter. Launcher being planned will be parachuted.

Army's 101st Ready for USAF Airlift

By Claude O. Witze

Ft. Campbell, Ky.—U.S. Army's famous 101st Airborne Division, reactivated, streamlined and glowing with spit and polish, is ready to fight anywhere in the world if the USAF can provide the transportation.

Army Secretary Wilber M. Brucker says he has been assured in Pentagon conferences that there is sufficient airlift available to move the 101st "Screaming Eagles" Division. In the new organization, this means 11,500 men and their equipment to launch and face atomic weapons.

Brucker's statement, made here during a full day of reactivation ceremonies, stands in contrast to testimony of last May before a Senate Airpower Investigating Subcommittee hearing in Washington. At that time, Maj. Gen. Earle G. Wheeler, Army director of plans, and Lt. Gen. James M. Gavin, chief of research and development, testified that USAF capability did not meet Army airlift requirements, particularly if the Strategic Air Command and Tactical Air Command needed the capacity for higher priority flights.

Brucker's statement at Ft. Campbell was understood to mean that USAF Secretary Donald A. Quarles has promised that strategic and tactical transport planes will be provided if the 101st is called upon to put out a "brush fire" uprising in some foreign country.

According to Maj. Gen. Thomas L. Sherburne, commander of the 101st, his troops would need the equivalent of 350 Douglas C-124s for a strategic haul and 600 Fairchild C-119s on a tactical mission.

The USAF is known to have little more than 400 C-124s scattered among SAC, the Tactical Air Command and

ONE of the new pieces of equipment for 101st Airborne, a 16,000 lb. Caterpillar D6S operated by division's 326th Airborne Engineer Bn. Bulldozer can be parachuted.

CRANE-SHOVEL weighing 14,700 lb. which can lift 18,000 lb. also can be transported in C-119. Unit can be parachuted without its 22½ ft. boom.

the Military Air Transport Service. About 1,100 C-119s were built and are now scattered across the U. S., Europe and the Far East. The task of training the 101st has been assigned to the Tactical Air Command.

Fairchild Transports

Brucker said he had pressed the airlift issue in top Defense Department circles following the hearing before the Senate subcommittee and is now satisfied that the USAF will take care of the Army's needs.

"I am satisfied with this assurance," he said, "but I am following it up to make doubly sure."

In addition to its C-124s and C-119s, the USAF has a growing number of Fairchild C-123 assault transports coming into use. Eventually, the C-119 is to be replaced by the higher capacity Lockheed C-130 turboprop transport and the C-124 by the newer and bigger Douglas C-133 and C-132.

Brucker gave evidence that the USAF cannot expect any reduction of Army pressure to provide increasing air lift capacity. He indicated that the 101st will be followed by a second streamlined airborne outfit and then by two infantry divisions that will be cut down and lightened to make them air transportable.

The infantry divisions would not be expected to haul their heavy equipment by air, he said.

One of the impressive things about the reorganized 101st cut down to 11,500 men from the World War II level of 17,300 is the fact that it can be moved with about half the aircraft needed by a conventional airborne division.

Firepower has been stepped up in this more compact and mobile division.

Gen. Shepherd described his outfit as a fire brigade and claims that three divisions like it could have stopped or prevented the Korean war.

There is little doubt in the minds of those who witnessed the new 101st's first dress review that it could be used effectively in such a current impasse as exists in the area of the Suez Canal. Here is a case where Britain and France were mutually eager to use military persuasion but lack enough conventional armed forces capable of landing and controlling the situation.

Fire Control Groups

The 101st has five combat groups, organized to give maximum control with minimum control personnel. Lt. Col. Leo H. Schweiter, G-3 for the 101st, says this permits a greater emphasis on the combat arms of the division, or to state it in another way, it allows a higher percentage of foxhole strength, the supporting elements having been organized on a mistere or marginal basis.

In this phrase Col. Schweiter clearly linked the streamlining of both airborne and infantry divisions to the Army's evident acceptance of the fact that it must do its job with fewer men as the growing military budget and potency of weapons force a personnel cut.

Lightweight Equipment

For mobility emphasis in the 101st is upon lightweight equipment. Except for the Honest John rocket missile, everything can be transported in the C-119.

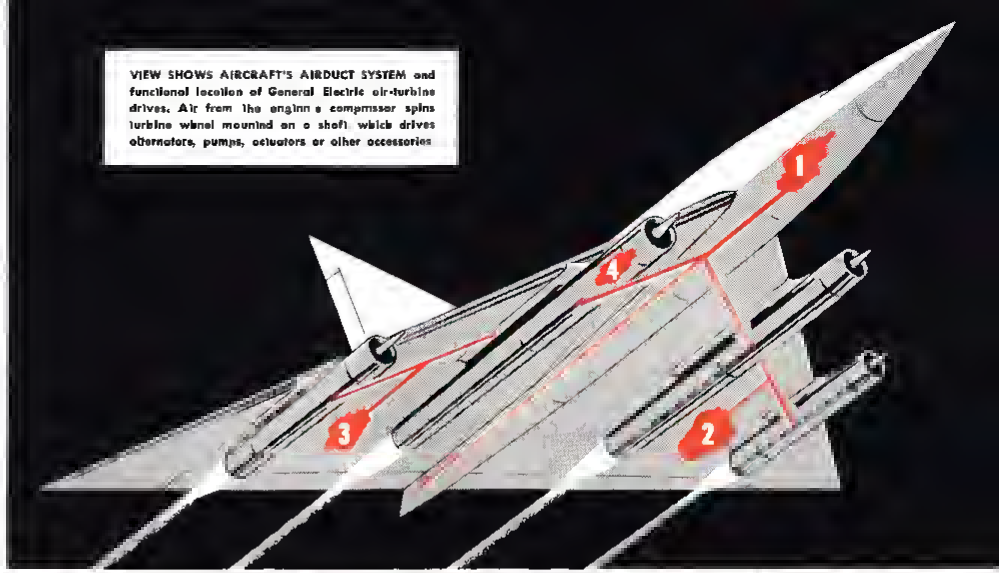
This has brought about a revolution in equipment that still is going on. Among the new items in the 101st's inventory of fighting tools:

- **T44 rifle,** weighing only 8.4 lbs., is a .30 cal. weapon that can fire 750 rounds a minute. It is expected to replace the M series of .30 cal. rifles and carbines as well as the M3 .45 cal. submachine gun.
- **Mechanical Mule,** to replace the Jeep, weighs 760 lb. and can carry 1,000 lb. over rough terrain. It resembles a mechanical baby carriage with a platform on top. The soldier can not ride in it but he can haul quantities of supplies up and down steep grades.
- **Spat,** a self-propelled 90mm. gun, that weighs 16,000 lb. and is operated by a crew of three. It can be delivered by parachute.
- **T161 general purpose machine gun** weighs only 46 lb. and is scheduled to replace three models now in use.
- **Airborne bulldozer,** weighing 16,000



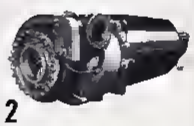
Fairchild C-123B Test

USAF and Army combined to aid in employment and suitability testing of Fairchild C-123B Provider by a project team from the Operational Test Center at Eglin AFB. Paratroops from Army's 82nd Airborne Division are jumping from the new assault transport over the drop zone at Fort Bragg, N. C. Crew of C-123B is from 513th Troop Carrier Group at Sewart AFB, Tenn.




1

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Valve Talk

FOR WM. R. WHITTAKER CO., LTD.
BY MARVIN MILES

Because Whittaker is determined to stay ahead in the aircraft valve field, John S. Fitzpatriek has a new job.

At 36, John has been appointed director of Whittaker's laboratories and his assignment is two-fold — to step-up the capabilities of the company's present labs and plan new laboratories to meet the driving urgency of a fast-changing era.

A mechanical engineering graduate of Louisiana State, he went to work for Boeing in 1942 in powerplant analysis. A year or so later he transferred to experimental flight test where he spent three years during the intensive development of the B-29 Superfort.

After the close of World War II Fitzpatrick's particular knack for mechanics and test work brought his assignment to Boeing's powerplant fuel test facilities. He spent eleven years in this highly technical department, then — because of his outstanding ability — he was made a powerplant staff group leader on a new aircraft.

During his fourteen years with Boeing John worked with Whittaker products and became thoroughly familiar with them. He also became well acquainted with Whittaker representatives — a combination of experience, understanding and appreciation that led to his affiliation with the Southern California valve concern a few months ago.

Fitzpatrick knows only too well the demands of this revolutionary technical age, the skills and facilities that must be available to keep ahead of it. On the basis of his experience he can foresee the multiple problems being shaped-up by ever higher pressures, flow rates and temperatures, ever greater acceleration and vibration stresses.

"The character of the business has changed radically," he explains. "In the old days a few fuel shut-off valves did the trick. Today, developmental costs represent one of the biggest expenditures on the books.

"Parts and labor for a new unit may run, say, $2000, but it may cost $50,000 to qualify it!"

Planning new laboratories that will adequately test developments for the thermal barrier challenge is one of Fitzpatrick's primary responsibilities.

Ambient temperatures, for instance, are approaching — and in some cases passing — the point of spontaneous fuel ignition.

In building valves that will handle fuel at great heat Whittaker must keep abreast of new fuel developments, and have test ovens and heat exchangers to simulate the ambient temperatures of prolonged high speed flight.

Such facilities to study the searing effects of heat and those for testing missile units — valve systems handling acids, helium, hydrogen peroxide, etc. — will be part of the new laboratories, together with extensive new equipment to analyze acceleration and vibration effects.

The demand for expanding and modernizing laboratory facilities is not confined to the major manufacturers and the big test concerns. It faces the industry as a whole if the complex problems wrought by speed, range and altitude are to be solved. So widespread is the challenge, so varied the tasks, that present day equipment even when combined with the work of outside test agencies can scarcely handle the work load imposed.

Then, when the factor of time is induced into the problem — time as a factor of both efficiency and cost — it becomes apparent that the only answer is expansion.

Whittaker has recognized the necessity and given John Fitzpatrick the task of organizing and expediting the new laboratories.

The forthcoming lab expansion is part of Whittaker realism. To hold the front position in a competitive field, plans and commitments for the future are as important as today's successes.

lb. and a crane shovel at 14,700 lb. The latter can lift 18,000 lb.

In addition to its role of getting the 101st to and from the scene of battle, aviation has an organic part to play in the new division.

An aviation company is included, with both fixed wing aircraft and helicopters. Helicopters also will be used for resupplying the division in the battlefield, and for evacuation, reconnaissance, observation, etc. Within the combat groups, everything except the 90 mm. assault gun can be transported by the Sikorsky H-34 or Vertol H-21 helicopter.

No one at Ft. Campbell holds that the 101st is the last word. Great emphasis is placed on the fact that lighter and better weapons are being developed, including a lightweight launcher for the Honest John that can be moved by a helicopter. The rocket itself also is being improved, and the present version was described by Gen. Sherburne as an "interim weapon" in his arsenal. Its successor will be delivered to his troops by parachute.

In addition to lighter weapons and ground equipment the 101st has a challenge for the aircraft industry. It wants more and better helicopters or STOL aircraft that will give it improved mobility once it is committed behind the enemy's lines.

Army Takes Over Own Pilot Training

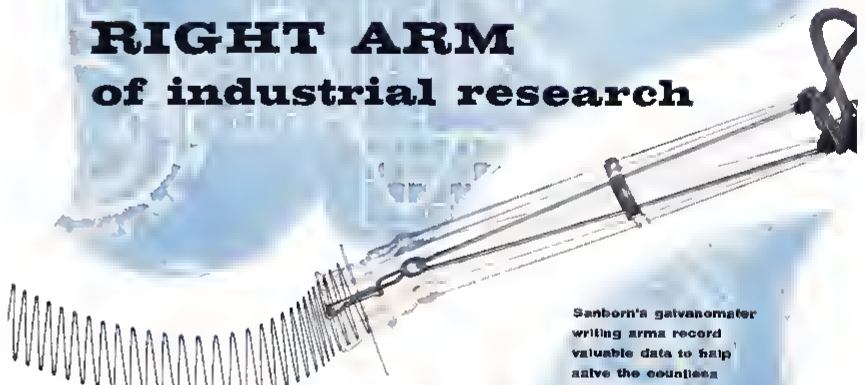
Wright-Patterson AFB, Ohio—The Army has taken the last major step towards control of the training of its helicopter and aircraft pilots.

Through the Air Force Air Materiel Command, Army awarded a $2,383,000 cost-plus fixed fee contract to William J. Graham and Son, of Pittsburgh, Pa. and Mariana, Fla., for operation of the fixed-wing primary school at Edward Gary AFB, San Marcos, Tex. The contract, dated last Sept. 18, runs until July 1.

The Defense Department decided early this year to let the Army train its own pilots (AW Apr. 30, p. 31) after a long wrangle in which Air Force objected to the growth of the Army's aviation program. Last August, the Army awarded Southern Airways Co., of Atlanta, Ga., an $890,215 contract to operate its new primary cargo helicopter pilot training school at Camp Wolters, Tex., formerly Wolters AFB, which the Army took over from the Air Force last July 1. This training is now done at the Army Aviation Center, Ft. Rucker, Ala.

The first helicopter class will report to Camp Wolters next month to undergo four weeks of pre-flight training—a modified type of officer candidate course—before beginning flight training.

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Production News from Bridgeport Thermostat



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on Jan 7. The contract calls for providing 27,000 flying hours before June 30. Each class will have approximately 50 students, and a new class will enter training every four weeks.

Gary AFB's name will be changed just as Wolters' was, but no decision has been made on the new name. The Graham and Son contract allows for one pilot instructor for each three students, and one academic instructor for each 21 students.

Approximately 100 students will be enrolled in each class. The Army will provide Cessna L-19s, with Graham and Son providing the maintenance. More than 60,000 flying hours will be accomplished by the end of June.

The contractor was to begin phasing his operation into that of the Air Force this week. Five Air Force taught classes are being canceled as the contractor takes over. The first contractor class will report Dec. 31, and the number will build up to approximately 500 in training.

The Air Force will surrender complete jurisdiction to the Army on about Jan. 1. Any subsequent contracting will be handled by the Army.

Training of Army rotary wing (non-cargo) pilots will remain at Ft. Rucker.

Army Contracts

Following is a list of unclassified contracts for $25,000 and over, as released by Army Contracting Offices:

QUARTERMASTER RESEARCH AND DEVELOPMENT COMMAND, Natick, Mass.

Pennsylvania State University, University Park, Pa., development of air drop packaging design (NEGOT DA19-129 QM-386), job, $99890.

Endicott Johnson Corp., Endicott, N. Y., boots, service, black, mildew resistant (NEGOT DA19-129 QM 935), job, $94015.

CORPS OF ENGINEERS, U. S. Army. Office of the Division Engineer, New England Division, 159 Causeway St., Boston 14, Mass.

Kirkland Construction Company, Inc., 289 Beni Street, Cambridge, Mass., construction of additional buildings for Nike battery #10, Bridgeport Defense Area, Orange, Conn., (IFB-12-918-ENG-56-103B), job, $349141.

CORPS OF ENGINEERS, U. S. Army. Office of the District Engineer, Detroit District, 600 East Jefferson Ave., Detroit 26, Mich.

Forrester Construction Company, 600 Sill Building, Flint 2, Mich., construction of airfield buildings, including all related work necessary and appurtenant thereto, at Wurtsmith Air Force Base, Oscoda, Mich. (IFB ENG-20-094-56-58), job, $145889.

J. A. Fredman, Inc., 733 South Paddock St., Pontiac, Mich., construction of supporting tactical facilities, including all related work necessary and appurtenant thereto, in the vicinity of Pontiac, Mich. (IFB ENG-20-094-56-84), job, $140111.

Forrester Construction Company, 600 Sill Building, Flint 2, Mich., construction of supporting tactical facilities, including all related work necessary and appurtenant thereto, in the vicinity of Mt. Clemens, Mich. (IFB ENG-20-094-56-85), job, $133,934.

A. J. Etkin Construction Company, 10111 Capital Avenue, Oak Park 37, Mich., construction of supporting tactical facilities, including all related work necessary and

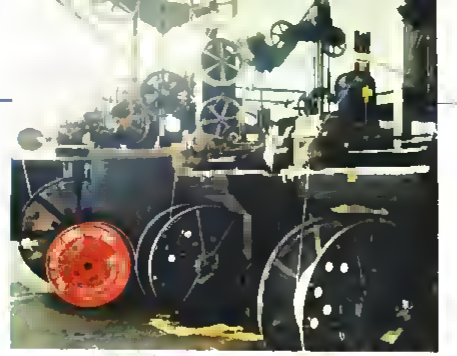


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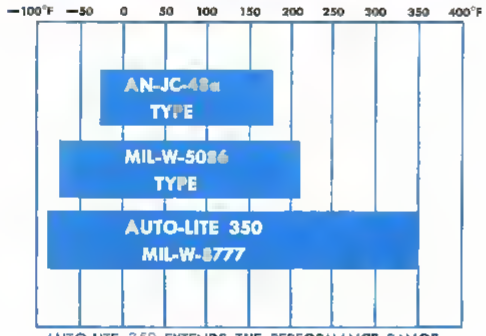


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Conductor in Auto-Lite 350 Wire is top electrolytic grade copper, silver-plated. Insulation consists of heat resistant silicone rubber, fibre-glass separators, and fireproof braids.

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- Smokeless.
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- Meets Spec MIL-W-8777, U.S.A.F.
- Manufactured in sizes 22 thru 2/0.
- Resistant to modern aircraft hydraulic fluids, lubricants and fuels for both reciprocating and jet-type engines
- No discoloration at maximum operating cable temperatures.
- Easy printing of circuits with conventional marking machines.

G.	Auto-Lite Part No.	Conductor	Gross* Copper Wt. (Lbs./M')	Nominal Diameter (Inches)	Nominal Weight (Lbs./M')	Footage Per Reel** (Approx.)
22	107051	19 x 34	2.43	.085	5.73	7000
20	107052	19 x 32	3.87	.095	7.58	6000
18	107053	19 x 30	6.16	.110	10.56	4500
16	107054	19 x 29	7.78	.125	13.27	4000
14	107055	19 x 27	12.35	.146	19.05	2500
12	107056	19 x 25	19.65	.166	27.4	1500
10	107057	105 x 30	35.0	.196	45.5	1000
8	107058	133 x 29	56.7	.245	70.3	1500
		Following Sizes Available for Use by W.A.D.C. Contract Permission				
6	151562	133 x 27	88.0	296	104.4	600
4	151544	133 x 25	141.0	358	162.2	500
2	151545	686 x 30	223.0	428	256.1	400
1	151546	833 x 30	274.0	460	310.4	300
1/0	151563	1078 x 30	350.0	536	402.2	200
2/0	151671	1323 x 30	435.0	593	495.0	200

*Gross copper weight including scrap allowance for DMS calculations

**Non returnable reels. Larger reels available on request for sizes 22 through 2/0

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CONDENSED AIRCRAFT WIRE SPECIFICATIONS

product	military spec	type of insulation	braid	outer jacket	finish	shielded	additional identification	range all sizes	remarks other specifications
Copper (Annealed) Low Tension Cable	Mil W-5086	Plastic-PVC	50% glass 50% cotton	none	nylon lacquer	see note # (1) below	Auto-Lite Type A	22 thru 2/0	
		Plastic PVC	100% glass	extruded nylon	none	"	Auto-Lite Type B	22 thru 10	
		Plastic PVC	none	extruded nylon	none		Auto-Lite Type C	22 thru 10	
		105 C PVC	100% glass	extruded nylon	none		Auto-Lite Type B-1	22 thru 12	Boeing BMS 13-5C
		105 C PVC	100% glass	extruded nylon	none		none	22 thru 12	Boeing BMS-13-12 Super Skydrol resistant
		105 C PVC	100% glass	extruded nylon	none	see notes # (1) & (2) below	Auto-Lite Type B-3	22 thru 12	Lockheed LACI-140D
		105 C PVC	none	extruded nylon	none	see note # (1) below	Auto-Lite Type C-1	22 thru 12	
		105 C PVC	1st—100% glass 2nd—nylon fiber	none	nylon lacquer	"	Auto-Lite Type Y-1 Auto-Lite Type E-2	10 thru 2/0 10 thru 2/0	Boeing BMS-13-5C Lockheed LACI-1400
		105 C PVC over braid	120% glass under PVC	extruded nylon	none		Auto-Lite Type Y-1	22 thru 12	
	Mil-C-7078A	Plastic PVC	50% glass 50% cotton	none	nylon lacquer	yes—83A wire	Auto-Lite Type A	22 thru 2/0	
		Plastic-PVC	100% glass	extruded nylon	none	over outer jacket under outer jacket	Auto-Lite Type B Auto-Lite Type B-1 Auto-Lite Type B-3	22 thru 10	
		Plastic-PVC	none	extruded nylon	none	over outer jacket under outer jacket	Auto-Lite Type C Auto-Lite Type C-1	22 thru 10	
Copper, Silver Plated, Stranded Conductor	Mil-W 8777	Silicone rubber	1st—100% glass 2nd—synthetic yarn	none	high temp lacquer	available—see note # (3) below	Auto-Lite Type 350 High Temp. Wire	approved 22 thru 2/0	
		Silicone rubber	glass fiber	extruded nylon	none	yes	Chance Vought	18 thru 2/0	CVA 1068
Copper Hook-Up Wire	NAS-702	105 C PVC	none	nylon-optional	none	see note # (1) below		22 thru 12	
	Mil-W-5274A	Plastic-PVC	none	extruded nylon	none	"	Type 1 Class A	22 thru 12	
		PVC two extrusions	100% glass (between PVC's)	extruded nylon	none	"	Type 2 Class A	22 thru 12	
	JAN C-76	Plastic PVC	none	nylon optional	none	"	Type WL	22 thru 8	
		Plastic PVC	glass-optional	none	lacquer (opt.)	"	Type SBH	22 thru 8	lacquer over braid
		Plastic PVC	glass-optional	extruded nylon	lacquer (opt.)	"	Type SKHV	22 thru 8	Boeing BMS-13-4a
	Mil W-76A	Plastic PVC	none	nylon-optional	none	"	Type LW	22 thru 8	
		Plastic PVC	opt —glass or synth.	none	lacquer (opt.)	—	Type MW	22 thru 8	lacquer over braid
		Plastic PVC	opt —glass or synth.	none	lacquer (opt.)	"	Type HW	20 thru 18	lacquer over braid
	Mil-W 16878-A	105 C PVC	optional	nylon-optional	none		Types B C D	28 thru 8	
		Silicone rubber	optional	none	lacquer	no	Type FF	24 thru 4/0	
Aluminum (Hard Drawn) Low Tension Cable	Mil W 7072	105 C PVC	1st—100% glass 2nd—nylon fiber	none	nylon lacquer	no	—	8 thru 2/0	Type EC Aluminum
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(3) Available to Mil C 7078A with either tinned or silver plated copper



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appurtenant thereto, in the vicinity of Wyandotte Mich (IFB ENG-20-064-56-46) job $1124259

Joseph A. Rose Company, 332 Sexton Building, Minneapolis 15 Minn construction of Ordnance storage facilities including all related work necessary and appurtenant thereto at K I Sawyer Air Force Base Marquette County Mich. (IFB ENG-20-064-56-401) job $1048000

A. J. Etkin Construction Company, 10111 Capitol Ave., Oak Park 37 Mich. construction of ordnance storage facilities, including all related work necessary and appurtenant thereto, at Wurtsmith Air Force Base Oscoda, Mich. (IFB ENG-20-064-56-01), job $1226113.

USAF Contracts

Following is a list of unclassified contracts for $25,000 and over as released by Air Force Contracting Offices

ROME AIR FORCE DEPOT, Griffiss Air Force Base, Rome, N. Y.

Steward and Stevenson Services 4524 Harrisburg, Houston, Texas modification kit AN/FPS 6 136 ea, (RFP 30-635-57-4244Q); $27735

I T-E Circuit Breaker Company 601 E. Erie Ave., Philadelphia 34, Pa. reflector-antenna AN/CPN-18 20 ea, (RFP 30-635-56 4292Q), $178200

Crescent Insulated Wire and Cable Company, Trenton N. J. cablepower elec 2 conduc 10AWG IAW RDL spec J-C-103 220500 feet (RFP 30-635-57 4107Q) $24177

Equitable Paper Bag Co., Inc., 49-56 Van Dam Street Long Island City, N. Y., envelene photographic negative 23900 box (RFP 30-635-56-4475Q) $38192

The Haloid Company, 2-20 Haloid Street Rochester 3 N. Y., paper, 18" x 350 ft. recording, orthn semi-matte 1300 roll paper 11" x 350 ft recording luster, smooth 600 roll, paper 10" x 15", type IVA, high speed 1377 pkg (RFP 30-635 56-4482Q), $104178

Eastman Kodak Company, 343 State Street, Rochester 4, N. Y., film, 0.481" x 100 ft, type 1A class L 1720 roll, film, 35mm x 100 ft type II class N 3310 roll film 16mm x 100 ft type III class L, 4115 roll, (RFP 30-635-56-4486Q) $65476

Eastman Kodak Co., 343 State Street, Rochester N. Y. film 35mm x 1000 ft MP, variable area, 750000 feet; film 35 mm x 1000 ft MP safety base 4600000 ft; film 35mm x 1000 ft MP safety base 2400000 ft (RFP 30 635-56-4478Q) $123424

Eastman Kodak Company, 343 State Street Rochester 4, N. Y., film 16mm x 1200 ft fine grain sound recording 2=2000 feet; film 32mm x 2000 ft fine grain release positive, 6400000 feet film 16mm x 1200 ft, fine grain release positive 4320000 ft, (RFP 30-635-56 4460Q) $1067733

E. I. du Pont de Nemours & Company, Photo Products Department, Wilmington 98 Dele., film, 35mm x 1000 ft neg pan 575000 feet, film 35mm x 1000 ft fine grain duplicating neg 1200000 feet film 35mm x 1200 5mm grain duplicating neg 180000 feet (RFP 30-635 56-4480Q), $60000

Grant Photo Products Inc., 1900 Detroit Ave., Cleveland 7, Ohio paper 10" x 20", type 1E contract Nr 1. 1259 pkg., paper 82 x 200 ft. SW projection contract nr 6 700 roll, paper 10" x 15", type IIE contract nr 3 832 pkg, $42090

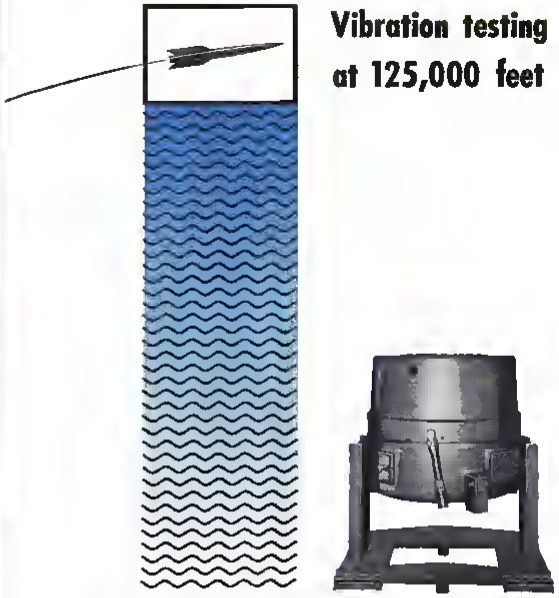
AMC WRIGHT-PATTERSON AIR FORCE BASE, Ohio

Barton Rogers Technical Training Aids, Inc., Cincinnati, Ohio cockpit procedure trainer for T-33A aircraft spare parts maintenance data, (FR FH-230000), $942713

Aircooled Motors, Inc., Syracuse N. Y., 0-235-5R engines A10-2000 special tools and GHE maintenance data (FR 672017 Q') $336782

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Mitchell Camera Corp, 666 West Hervard St Glendale 4 Cal camera motion picture 16mm hi-speed. (MIPR R50-178-28375-G6-(1)ASO) 1 re

Sperry Band Corp Sperry Gyroscope Co Great Neck L. I N Y components for the C-131D aircraft making up an E 4 autopilot (PRISA)-721748 721746-1 and SA-611158 QI $249907

Sperry Gyroscope Co Div of Sperry Band Corporation Great Neck, Long Island, N Y receiver transmitter RT-204A/APN-60 407 ea mounting MT-824/APN-60 608 ea control radio beacon 612A/APN-60 407 ea coupler directional CU 341/U 407 ea antenna AS-581/APN-60 407 ea (PR GE-642672 and Amend 1 2 3 4 & 5) $1383178

Radio Corp of Amrrica 11819 W Olympic Blvd., Los Angeles Cal radar set AN/AFS-42 101 ea RT-278/rarrivrr 101 ea AS-428A/antenna 101 ea. (PR 642668-2), $17600050

Bell & Howell Co 7100 McCormick Rd Chicago 45 Ill projector motion picture sound 16mm type AQ-2A(1) 1004 ea. (PR MO-599920 598943 599650) $961450

S A Maurer Inc 37-01 31 St Long Island City 1 N Y, camera, type P-2 1962 re magazine, 26 ft 1118 ea (PR 671410 and 6714111) $1213969

Aeroflex Machine & Metals Inc U S Gauge Div Sellersville Pa. transmitter pressure torque type MG-1 (PR 638052 1171 ea $158700

Ampco Corp, 2835 Northwestern Ave Chicago 18 Ill, spare parts for type D-4 16 mm sound motion picture projector (MIPR R 50-10839 & MO-600830) $170949

Arroflex Laboratories, Inc 34-06 Skillman Ave Long Island City N Y. vrrriral reference units 12 ea box assemblies pitch gear 12 ea box assemblies, roll gear 12 ea (MIPR R50-161 23375 G6/5/ASO) $70324

General Electric Co, 2600 Far Hills Ave Dayton Ohio generator direct current gas turbine driven 30 volt 300 amp type MG-1 (installations) (spares) (PR PE 635043 Q"1 144 ea $58733

MEMPHIS AIR FORCE DEPOT, Mallory Air Force Station, 4000 Jackson Ave Memphis 2 Tenn

Boston Woven Hose & Rubber Co. 26 Hampshire St Cambridge, Mass hose rubber IFB 40-004-56-261 1200 ea., $44 040

Walter Kidde & Co., Inc 675 Main St, Belleville N J. cooverssion kit IFB 40-004-56-310 290 eats $34935

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Dynamic Air Engineering Inc 7412 Male Ave Los Angeles Cal fan rentrifugal applicable spd 7130042R heatrr garkage 83 ea $8908 fan vaneaxial applicable C121-94 ea $30480 (RFP 01 606-s-8-34)

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Of Aviation Week published weekly at Albany New York for October 1 1956

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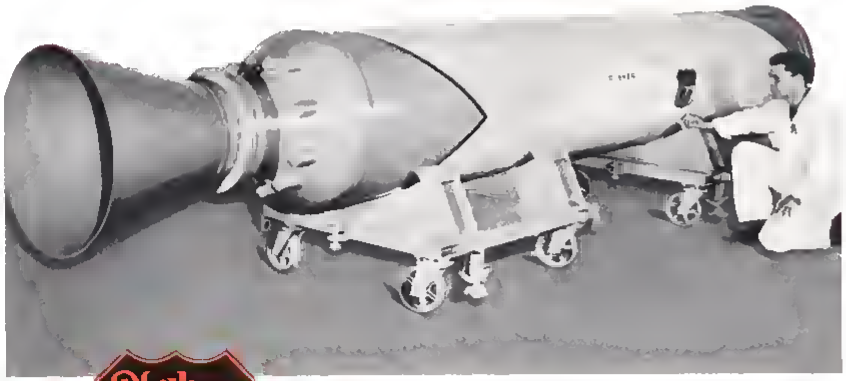
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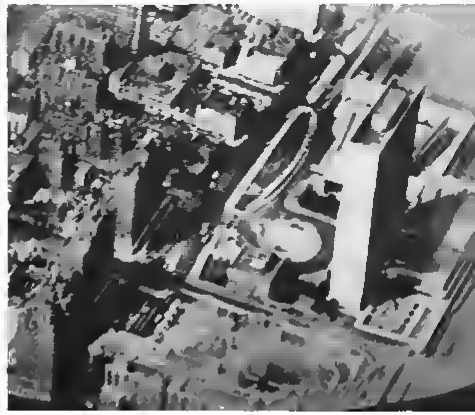
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ARMY'S new TV drone controlled from Jeep mounted station (above), can reconnoiter behind enemy lines, transmit back to ground commanders a TV picture of what it sees. Photo right shows drone view of United Nations building as seen on TV screen 40 miles away, at Ft. Monmouth, N. J.

Army Drones Can Televise Enemy Lines

Remotely controlled drone versions of the L-17, which can reconnoiter behind enemy lines simultaneously transmitting a TV picture of what they see to ground commanders, are undergoing evaluation by the Army Signal Corps. By replacing a two-man crew with avionics equipment, the Army hopes to eliminate the hazard of low-level behind-the-line reconnaissance as well as speed the transmission of vital intelligence data.

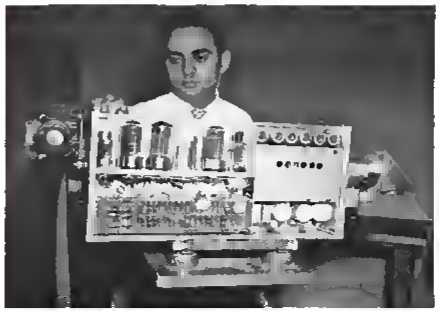
The drones and their TV cameras are controlled from a portable Jeep-mounted ground station which includes three-axis drone controls and the TV receiver and screen. (See photo, upper left.) The QL-17 is stabilized by a 42 pound automatic pilot. The airborne TV camera's diaphragm opening, focus and viewing angle also is controllable from the ground station.

Temco Aircraft Corp. converted six L-17B aircraft into QL-17s and developed the portable ground station equipment, under the sponsorship of the Army Signal Corps Engineering Laboratories (SCEL), Ft. Monmouth, N. J. Three of the six QL-17s were equipped by SCEL as TV drones.

The TV camera, an image orthicon type, and its associated UHF transmitter were built by Austin Co. to Signal Corps specs. The complete airborne TV station, including camera, weighs 135 pounds. The radio control equipment, operating also in the UHF band, was developed by Babcock Engineering, Inc., which produces miniature radio control equipment for model airplane builders.

Maximum range of the airborne TV transmitter is approximately 45 miles. One of the three TV drones, being tested by SCEL, carries a safety pilot because test flights are conducted over heavily populated East Coast areas. However, two other TV-equipped QL-17s undergoing tests at Army Electronic Proving Grounds, Ft. Huachuca, Ariz., are being flown without safety pilots, Army says.

A lightweight ground radar, the AN/TPN-32, built by Laboratory For Electronics, Inc., is used to keep tab on drone position when it is beyond line of sight.





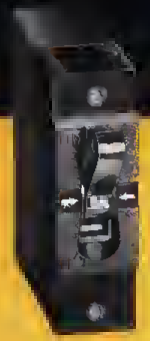
AIRBORNE TV camera transmitter (left) mounts in belly of QL-17 (right). Lens setting and viewing angle can be remotely controlled

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Circuit breakers

Transistor Reliability Improved, Operates Nearly 18,000 Hours

By Philip J. Klass

New York—The reliability of transistors has increased to the point where their mechanical ruggedness and stability now exceed that of many passive circuit elements (resistors, capacitors), and further advances in reliability are close at hand.

This encouraging report was made by C. H. Zierdt, Jr., of General Electric at a recent Defense Department sponsored symposium here on transistor reliability. The report was based on extensive life testing including one batch of transistors which have operated at rated power for nearly 18,000 hr without a single catastrophic or degradation-type failure, except for "infant mortality" failures during the first 24 hours. Since these units were manufactured in 1954, new techniques have been developed which should make current units even more stable and reliable.

Stability Improved

Other encouraging news for avionic equipment designers, reported by Zierdt, included:

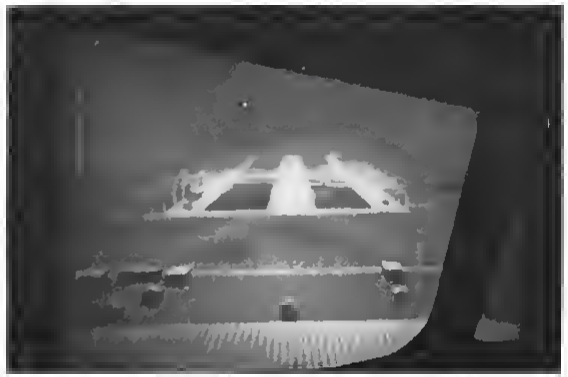
- **Stability of transistor characteristics** has improved to the point where "slow death", due to continuous change of characteristics with time, has been practically eliminated.
- **Higher temperature limits** for transistors has been made possible by new GE developed technique which raises top operating limit for germanium transistors from 85C to 100C and permits storage at temperatures of 135-140C. Comparable increases in silicon transistor operating and storage temperatures should also result. (GE has not disclosed any details of its new technique, but Zierdt told AVIATION WEEK that the special processing takes place after the transistor is assembled. An undesirable by-product of the processing is the slight lowering of the transistor's average current gain and its I_{co} collector-to-base current with emitter open.)
- **Shock** tests on transistors, performed by shooting them from a mortar and thereby subjecting them to an 8,000G shock for three milliseconds, produced a 60-75 percent survival. With minor internal transistor structural changes, Zierdt believes that even higher survival rates can be achieved.
- **Nuclear radiation** in substantial doses of gamma rays which can adversely affect the surface condition of a transistor, had relatively slight deleterious effects on silicon transistors somewhat more on germanium transistors, when units were suitably processed. However, Zierdt had nothing to report on the effects of the more serious type of radiation—neutron bombardment which destroys the internal structure of a semiconductor.

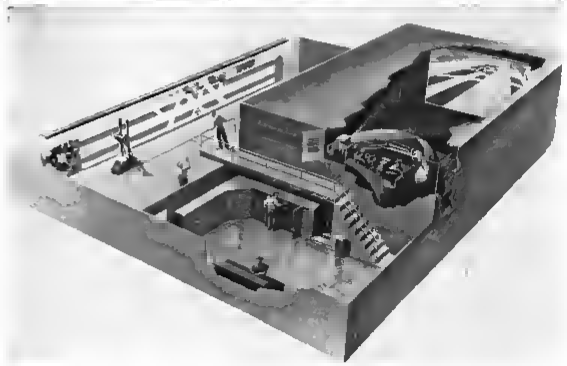
Re-cycled Continuously

In the previously cited life tests, GE used Type 2N40 germanium PNP alloy junction transistors. These were operated for 50 min. at rated power, turned off for 10 min., then re-cycled continuously.

Starting out with a batch of 43 units fresh off the 1954 production line, without any pre-aging, GE subjected them to storage at a temperature of 100C for 624 hr. Four of the units suffered catastrophic failures during the first 24 hr. The remaining 39 transistors were then put on the cycling test at room temperature.

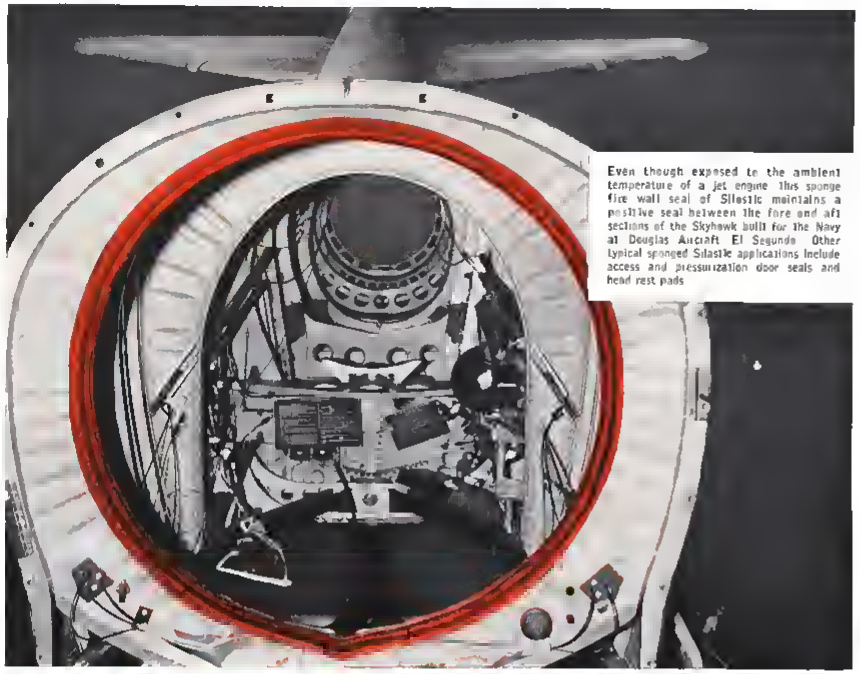
Six of these 33 units suffered appreciable shift of characteristics during the early portion of the life test but had returned to acceptable limits within 2,000 hr., Zierdt reported. After 9,000 hr., with no catastrophic or degradation failures, the batch was cut to 10 units.





TV Aids Simulator

Airport scene (top) from cockpit of DC-8 flight simulator uses closed circuit television called Telemma to achieve more realistic ground training. The airport appears to the pilot as it does on actual takeoffs or landings. Cutaway drawing (bottom) shows how system adds visual element to the sensations experienced by flight crew during transition training for DC-8 operation. At left, mounted on wall, is three-dimensional model of airport which is flashed on screen by television projector. Device can be used with flight simulator now being manufactured by Link Aviation, Inc.



Even though exposed to the ambient temperature of a jet engine this sponge fire wall seal of Silastic maintains a positive seal between the fore and aft sections of the Skyhawk built for the Navy at Douglas Aircraft El Segundo. Other typical sponged Silastic applications include access and pressurization door seals and head rest pads

SILASTIC SILICONE RUBBER sponge stays resilient from −130 to 500 F

Wherever performance can be improved or equipment made safer with a sponge rubber that retains its physical properties regardless of heat, cold, ozone or weather . . . a sponge made of Silastic,* Dow Corning's silicone rubber, is the answer. Available now in most any size, shape or color from leading rubber companies.

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Typical Properties of Silastic Sponge

- Temperature range, °F — 130 to 500
- Ozone resistance excellent
- Specific gravity 0.25 and higher
- Corrosion Noncorrosive to metal
- Structure Closed cell

Lightweight • Flexible • Weather resistant

If you consider ALL the properties of a silicone rubber you'll specify SILASTIC

first in silicones DOW CORNING SILICONES DOW CORNING CORPORATION • MIDLAND, MICHIGAN

to simplify test measurements.

As of today, the units have been on life test for nearly 22,000 hr., giving approximately 18,000 hr. of "on" time without a single failure.

Newer transistors, made between January and May of this year, were subjected to eight different environmental tests called out in MIL-T-25380, with a different batch of 250-300 transistors used for each test, Zierdt reported. (That is, no transistor was subjected to more than one type of test.)

Out of 2,050 transistors tested, there were a total of 30 failures (1.5%) of which 24 (1.2%) were catastrophic and six (0.3%) were degradation failures. The highest number of catastrophic failures (five) occurred during the salt spray test, while one third of the total degradation failures occurred in each of the following three tests: intermittent life, moisture resistance, and salt spray, Zierdt reported.

The fact that seven out of a total of 30 failures resulted from salt spray, and another four from moisture resistance tests, suggests that there is room for improved hermetic sealing techniques. GE's test program was partially supported by the Wright Air Development Center.

FILTER CENTER

► **New Tube For 70,000 Mc. Use**—"Retarding Field Oscillator" is name of new type radar power tube designed for operation at frequencies of 70,000 mc. and capable of use up to 100,000 mc. with reduced power output. Tube was developed by Ohio State University under Wright Air Development Center sponsorship. Tube is mechanically tunable over 2:1 frequency range and operates at relatively low voltage.

► **Neatest Trick Of The Week**—Invention of devices or techniques claimed to make airplanes invisible to radar are reported in the press nowadays with the frequency of the "discovery" of perpetual motion machines a few decades ago. The Scripps-Howard Washington Staff recently reported "Invisible planes—to radar? Navy thinks it can be done. Has project in research stage and under test at sea. It's an electronic mechanism in nose of 'vanished' plane which absorbs rather than repels radar waves. Other nations are working on it too, says Navy." Logical question: What absorbs radar waves that strike parts of the airplane other than the nose?

► **Piezoelectric Material For 500C**—A new piezoelectric material, lead metaniobate, which retains most of its properties at temperatures up to 500C, is now in pilot production at General Elec-

Pachmayr quarter-turn universal grip range fastener



Only Pachmayr gives you

positive lock

greater grip tolerance

higher strength

- meets MIL-F-8490
- positive mechanical lock (not a spring)
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Up to 40% weight reduction possible by the use of MENASCO's exclusive *Uniwelding* process which assures superior strength, greater consistency, and ductility in welds, *and*, excellent wear-resistance by the only proven method of hard chromium plating.

Illustrated are typical examples of what MENASCO can do with these two processes to fabricate titanium components for aircraft and missile applications.

Major aircraft manufacturers look to MENASCO for efficient engineering, product development and new fabricating techniques.

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Radar Remoter

New British Marconi microwave link demonstrated at recent Farnborough Air Show was used to pipe radar and TV pictures from London airport, 20 miles away. Marconi microwave link has 8 mc. video band width which enables it to handle two radar scope presentations, a 3.75 mc. TV picture, and voice.

Material is suitable for use in missile accelerometers. For details write GE's Specialty Electronic Components Dept., Syracuse, N. Y.

▶ **New RTCA Member**—Boeing Airplane Co. has been elected to membership in the Radio Technical Commission for Aeronautics.

▶ **Advanced Communications**—Air Associates, Inc., is developing "advanced airborne communications equipment" for Hughes Aircraft Co., under a $7.5 million contract. The communications equipment will be part of HAC's integrated avionics package for the Convair F-102.

▶ **Homer to Speak**—Richard E. Horner, Acting Asst. Secretary of the Air Force (Research and Development) will be the principal speaker at the East Coast Conference on Aeronautical and Navigational Electronics, Oct. 29-30, in Baltimore.

▶ **Transistorized Time Multiplexer**—Transistor replacement for mechanical telemetry commutators, which produces a pulse amplitude modulated (PAM) output from FM/FM input signals, has been developed by the Naval Ordnance Laboratory, Corona, Calif. An experimental unit, which samples 15 different channels at a rate of 10 per sec., reportedly has a maximum linearity deviation of less than 0.1% full scale, interchannel uniformity of better than 0.4% full scale, and total error due to zero drift and sensitivity change of less than 0.5% full scale. New transistorized multiplexer, reported at Wescon in a paper co-authored by J. M. Sacks and E. R. Hill, should be capable of switching rates of at least 15 kc., according to authors. Device consumes only 1 watt power, and its accuracy reportedly is virtually unaffected by 20% reduction in supply voltage.

Expansions, Changes In Avionics Industry

General Electric's Schenectady (N. Y.) Aeronautics and Ordnance Operation, activities in flight control, fighter armament and jet ignitions, have been consolidated with GE's Aircraft Products Dept., Johnson City, N. Y., previously responsible only for the company's bomber defense systems. Some of the professional personnel and facilities will be transferred to Johnson City early next year. Other Schenectady activities, such as the company's Flight Test Laboratory, hydraulic products section and advanced engineering will remain.

The Aircraft Products Dept. is one of five groups in GE's Defense Electronics Division.

Other recently announced changes and expansions in the avionics industry include:

▪ **Hamilton Standard**, division of United Aircraft Corp., has formed an electronics department "to solicit business ... over and above the division's own requirements for its turbine engine and propeller products." New department, located at firm's Broad Brook, Conn., plant, will be headed

a letter from Daddy TO: MARLENE HAFEMANN

Dear Kitten:

It occurs to me—as I cruise along dictating this epistle to my homely copilot (his shorthand is lousy) —that the time has come when you must stop playing Tricks or Treats on Halloween. Last week at home, I noticed, in a fatherly kind of way, that you have—or—ah—developed to the point where you must cease galevantin' up and down the street after Taps.

In any event, whatever you do, don't go Trickin' or Treatin' at 1313 Livitupp Lane where that bachelor advertising man, Hamilton Dreelmore, lives! Working on the Southwest Airmotive account may have affected his mind.

I'm en route to the National Business Aircraft Association convention, October 23-24-25 at Miami and my airplane, as usual, is flyin' smooth as silk. Southwest Airmotive, pushing closer to its Silver Jubilee in '57, uses no Tricks— just skill and reliability— in Treatin' me and other business pilots to flying's most experienced service. And, for the biggest Treat of all, SAC is under way full-speed building its great, new $2,000,000 business aircraft terminal. Here is proof to NBAA and everyone that SAC is no Johnny-Come-Lately, but that it has faith in business flying—and has kept this faith for a Quarter Century.

—And I've got faith in my 13-year-old, 5'3", 110-lb., red-headed, blue-eyed daughter. Don't you have ditto in Mr. Dreelmore.

Love, Daddy



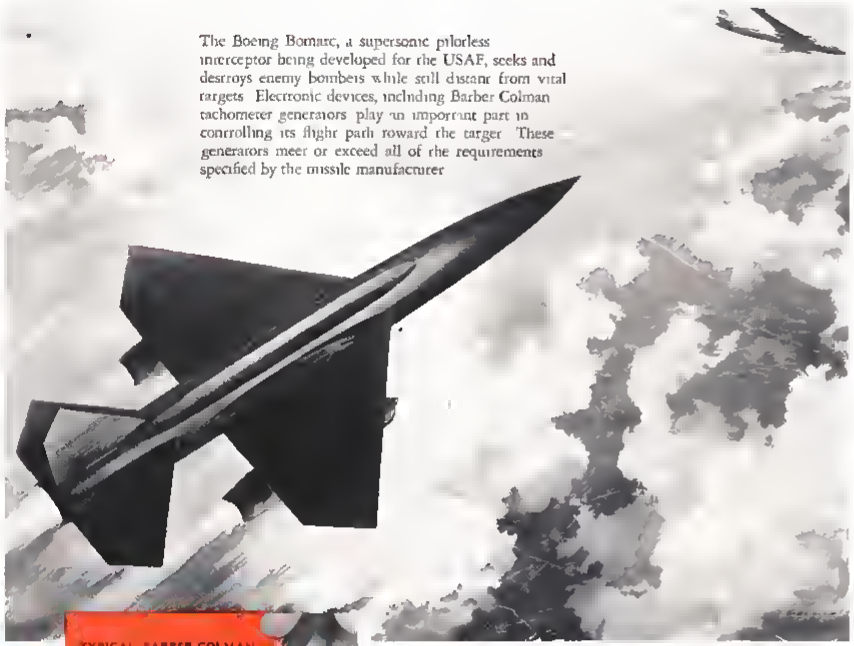
SOUTHWEST AIRMOTIVE CO. • LOVE FIELD • DALLAS, TEXAS

BARBER COLMAN

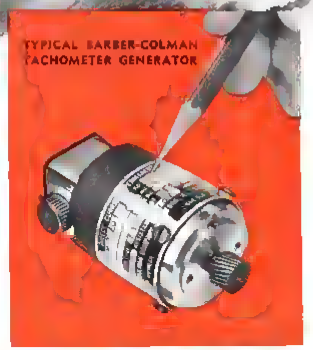
Aircraft Controls

help keep Boeing IM-99 missile accurately on course

The Boeing Bomarc, a supersonic pilotless interceptor being developed for the USAF, seeks and destroys enemy bombers while still distant from vital targets. Electronic devices, including Barber-Colman tachometer generators, play an important part in controlling its flight path toward the target. These generators meet or exceed all of the requirements specified by the missile manufacturer.



Artist's conception of Boeing Bomarc



The Barber-Colman tach generator used on this missile application is a special adaptation of the widely known Barber-Colman line of high quality d-c motors for aircraft.

The complete line of Barber-Colman aircraft controls includes: Actuators, Positioning Controls, Temperature Controls, Small Motors; Valves, Ultra-Sensitive Relays, Thermo-Sensitive Elements. Write today for literature or consult the Barber-Colman engineering sales office nearest you . . . Los Angeles, Seattle, Baltimore, New York, Montreal.

Barber-Colman Company

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AIRCRAFT CONTROLS • AUTOMATIC CONTROLS • INDUSTRIAL INSTRUMENTS • SMALL MOTORS • AIR DISTRIBUTION PRODUCTS
OVERDOORS AND OPERATORS • MOLDED PRODUCTS • METAL CUTTING TOOLS • MACHINE TOOLS • TEXTILE MACHINERY

by George J. Willis during its initial operation.

• **Leventhal Electronic Products Inc.**, maker of high power microwave equipment, is building new 55,000 sq. ft. facility in Stanford Industrial Park, Palo Alto, Calif.

• **U. S. Electronics Development Corp.**, Glendale, Calif., maker of precision capacitors, filters, and servo systems will build new 20,000 sq. ft. facility at Sahcoy and Ethel Streets in North Hollywood. Occupancy is slated for early 1957.

• **Circuit Instruments Inc.**, has moved to new 12,500 sq. ft. plant at 2801 Anvil St., North St. Petersburg, Fla. Company is subsidiary of International Resistance Co.

• **Sylvania Electric** has opened its new transistor-diode manufacturing facility at Hillsboro, N. H. Plant employs 150 people, expects to reach 300-350 by early next year.

• **Fansteel Metallurgical Corp.**, Chicago, will build new $6.5 million tantalum-columbium plant at Muskogee, Oklahoma. Tantalum is used in capacitors and its sister material finds use in experimental thermal nuclear reactors.

• **Bendix Aviation** will triple its Cincinnati Division's manufacturing facilities for nuclear and ultrasonic instruments with move to new plant at 3130 Wasson Road.

• **Minneapolis-Honeywell** has purchased the Hathaway plant in Boston to house its Transistor Division (currently located in Minneapolis) as well as the firm's Dedeam Division already located in Boston. New joint 115,000 sq. ft. facility is expected to employ 1,500 people.

• **Sierra Electronic Corp.**, San Carlos, Calif., instrument manufacturer, will build new 35,000 sq. ft. facility at nearby Bohannon Industrial Park at Menlo Park, Calif. Occupation is expected by year end.



Enemy Radar Locator

New radar direction finder developed by Stanford Research Institute instantly determines bearing to an enemy radar. The radar ADF's non-rotating antenna covers wide frequency range. SRI reports the development of novel technique for fabricating twisted short sections of waveguide (see insert) without internal waveguide distortion. Small 0.005 inch thick brass stampings whose external dimensions and rectangular holes match those of the desired waveguide were strung together on wires. The stack of stampings was then twisted to desired contour and finally soldered or brazed to form a continuous twisted waveguide.

Now! . . . the NEW
ROBINSON WIRE TWISTER
with DIAGONAL GRIP-HEAD



Faster, more efficient than ever! The new, slendernose DIAGONAL GRIP-HEAD is designed especially for those narrow-hard to reach places. Split-second whirling action safety-wires 3 engines in time required for one by any other method . . . saves as much as $140 per engine assembled.

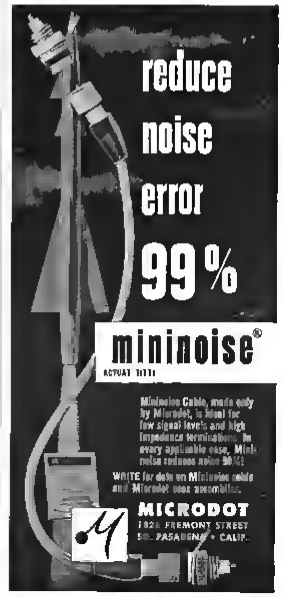
3-TOOLS-IN-1 . . . pliers-cutters-twisters. Side-cutting, oil-tempered head. Permanent bronze bearing. No adjustments. Jaws lock on wire, can't slip off. Perfect, uniform twist every time.

12" —for assembly line safety wiring. 15 oz. $21.50
9" —for bench work, sub-assemblies. 12 oz. $20.50

Unconditional Money-Back Guarantee. Send for complete details.

RALPH C. ROBINSON CO.
Box 494W No. Sacramento 15, Calif.

Canadian Distributor, Gensales, Ltd., Malton, Ont.



WHO'S WHERE

(Continued from page 23)

Changes

Frederick A. Fielder, general sales manager, Loewy-Hydropress Division, Baldwin Lima Hamilton Corp., Philadelphia, Pa.

Albert W. Cruer, Jr., director marketing research and **M. F. Mellinger**, export manager, Cessna Aircraft Co., Wichita, Kan.

Charles Knight, general manager, Facsimile Equipment Division, Air Associates, Inc., Orange, N. J.

John R. Lawther, production manager, Test Equipment Division, Consolidated Diesel Electric Corp., Stamford, Conn.

Herbert G. Schubert, advertising manager, Cannon Electric Co., Los Angeles, Calif.

O. L. Slay, Midwestern regional manager, and **Robert M. Maloney**, Eastern regional manager, Slick Airways, Inc.

Dr. William E. Frye has joined the staff of Lockheed Missile Systems Division research laboratories, Palo Alto, Calif. **Jean Richard Huynen**, associate research scientist, Palo Alto laboratories. Also **Eugene E. Crowther**, base manager, Lockheed Missile Systems Divisions flight test base at Holloman Air Force base, Alamogordo, N. M. Mr. Crowther succeeds **Everett E. Christensen**, now assistant flight test division engineer at the Missile Division's Van Nuys plant.

Robert Scott, manager and **Boyd Cillen**, assistant manager of newly opened Cleveland office of Airwork Corp., Millville, N. J.

Dr. Frank C. Miller, head of engineering laboratory, Hughes Aircraft Company's guided missile laboratories, Tucson, Ariz.

Christian F. Gort, plant engineer, Aviation Division, Sperry Rand Corp., Phoenix, Ariz.

Kirby F. Thornton, assistant manager, Sales Development Division, Aluminum Company of America, New Kensington, Pa.

James F. Lydon, director of administration, Georgia Division, Lockheed Aircraft Corp., Marietta, Ga. He succeeds **R. R. Kearton**, now Weapons System Manager. Also **Robert E. Fitzwilson**, assistant director—quality control, **Mark L. Wilton**, chief industrial engineer, **John F. Leahan**, manager industrial engineering dept., **Clarence H. Roha**, division manager purchasing division **Fred A. Kanzler**, manager purchasing dept., **John N. Buckley**, manager purchasing operations dept.

J. P. Donald Ganges, sales manager, Wright Aeronautical Division, Curtiss-Wright Corp., Wood Ridge, N. J.

Andrew A. Burns, general sales manager for North America, Sabena Belgian World Airlines.

Bruce Lockwood, **Robert R. Hunt**, and **Raymond B. Carroll**, senior sales engineers, Hamilton Standard, division of United Aircraft Corp., Windsor Locks, Conn.

LeRoy D. Allen, manager, Service Engineering Dept., Kollsman Instrument Corp., Elmhurst, N. Y.

H. Fletcher, assistant general manager, Georgia Division, Lockheed Aircraft Corp., Marietta, Ga. Also **Ralph J. Osborn**, manufacturing manager; **R. A. Mackenzie**, assistant manufacturing manager; **H. Lee Foore**, production manager, **William B. Rieke**, assistant production manager, **Nicholas Riccardi**, director of material.

Frank F. Strong, assistant treasurer, Chase Brass & Copper Co., Inc., Waterbury, Conn.

Nicholas M. Esposito, production manager, H. W. Loud Machine Works, Inc., Pomona, Calif.

Robert H. Pontton, senior sales engineer (Los Angeles, Calif.), Flexible Tubing Corp., Guilford, Conn.

Marvin Hobbs, director New Projects Department, Arma Division, American Bosch Arma Corp., Garden City, N. Y.

Chet R. Lubber, director sales administration, Frontier Airlines, Inc.

Victor J. Kayne has joined the staff of the Aircraft Owners and Pilots Assn., Washington, D. C. Mr. Kayne is a consultant and will assist in formulating and carrying out association policies concerning air traffic control.

G. Wickham Skinner, director of administration for the inertial guidance plant to be built near St. Petersburg, Fla. by the Aeronautical Division, Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

Leonard Colaud, director research, Kellett Aircraft Corp., Camden, N. J. Also **Al Yackle**, chief special projects; **Blair Bartley**, chief structures, succeeding Mr. Yackle, **David Gebhard**, chief preliminary design.

Lloyd M. Wilson, traffic Manager, Atlantic Division and **Leroy Simpson** superintendent-operations engineering, Pacific Alaska Division, Pan American World Airways.

Ray Patton, industrial relations manager, Hycon Manufacturing Co., Pasadena, Calif.

Royal
AMPHIBIAN NEWS

Notes on America's outstanding utility amphibian for business flying and charter service operation

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Go wherever you like in a Royal Gull . . . to hundreds of places where other planes can't take you . . . range up to a thousand miles. Put it down on land or water. Just one flight will convince you that its executive comfort, easy handling, responsiveness, and outstanding engine performance are incomparable. Arrange for a demonstration flight now!

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ARC's Course Director is TODAY's Big Name in Navigation Aids!

Pilots no longer have to perform mental computations to determine the exact headings required to intercept and fly a desired VOR radial or runway localizer. ARC's CD-1 Course Director, now in use in hundreds of aircraft, relieves the pilot of these problems and gives him time to concentrate on others at this critical period.

With ARC's CD-1 the pilot merely (1) selects his VOR or localizer station, (2) sets his Course Director to the bearing of the desired VOR radial or localizer, (3) turns his aircraft until the vertical needle of the cross-pointer meter is centered, and (4) continues to fly the aircraft, keeping the needle centered. The aircraft will intercept the selected track quickly and smoothly and at the same time compensate exactly for wind drift. No mental computations—no overshoot with resulting zigzags to bracket the desired course.

This useful and reliable equipment adds only 10 pounds to your aircraft. Ask your ARC dealer to install the CD-1, along with a dual installation of ARC's Type 15D VOR Equipment. The ease and precision with which you can then fly VOR and Localizers will be a revelation—and incidentally good insurance.

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Omni/ILS Receivers • Course Directors • UHF and VHF Receivers and Transmitters • LF Receivers
and Loop Direction Finders • 10-Channel Isolation Amplifiers • 8 Watt Audio Amplifiers • Interphone Amplifiers
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Dependable Airborne Electronic Equipment Since 1928

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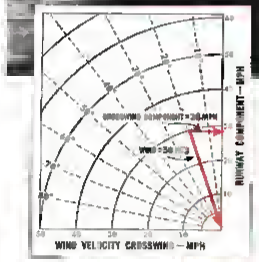
FLY WEATHER-WISE — Mobil

These weather items prepared in consultation with the United States Weather Bureau

APPROACHES AND TAKE-OFFS

AS AFFECTED BY WEATHER CONDITIONS





Crosswind Landings—Know the crosswind limitations of your aircraft. If you know the angle of wind to the runway, you can determine beam component following this diagram (Example above)

Temperature, terrain, altitude, wind velocity and wind direction—all affect landing and take off procedures.

When approaching an airport with thunderstorms in the vicinity, be on guard for sudden wind shifts or downdrafts. Sudden reversal from headwind component to tailwind may cause you to lose altitude and undershoot. This condition is even more critical on take-off with heavy load.

Remember, at higher altitude fields, you will land faster because air is less dense. (Also remember your actual TAS is 2% faster than indicated for each 1000 ft. above sea level.) However, in maneuvering you are concerned with INDICATED air speed which is the same at altitude as at sea level.



Effect of Terrain—Approaching over rocky terrain, plowed fields, paved roads in clear, hot weather, rising currents may cause you to overshoot. Descending currents over rivers, forests and wheat fields may have the opposite effect.

FORECAST: *Smoother landings with MOBIL AERO HYDRAULIC OILS*

Smooth, shock-free landings covering wide temperature ranges are possible with top-quality Mobil Aero Hydraulic Oils. These mineral base, extremely high viscosity index, low-pour oils have been specially developed to meet all aircraft hydraulic needs . . . are recommended and approved by leading manufacturers of hydraulic equipment. Good reason it *pays* to Specify Socony Mobil.

For Top Flight Performance—Make it **Mobil** *Leader in Lubrication for 90 years*

SOCONY MOBIL OIL COMPANY, INC., and Affiliates MAGNOLIA PETROLEUM CO. GENERAL PETROLEUM CORP., MOBIL OVERSEAS OIL CO., INC.



NEXT YEAR Southwest Airmotive starts operations within area bounded by heavy black line; remainder is in five-year plan.

Southwest Firm Builds 'Service Station'

By Erwin J. Bulban

Dallas—A $4 million "super service station" designed from the ground up primarily to service business and private aircraft is being built at Love Field near here by Southwest Airmotive Co. to keep pace with an expanding business volume. Company's sales in 10 years have been boosted from about $600,000 annually to that much every month. In the current fiscal year it expects to gross $7.5 million.

First phase of Southwest Airmotive's ultimate five-year expansion program will be operating by mid-summer next year, in time for celebration of its 25th anniversary as a fixed base operation. This initial portion of the master plan, costing approximately $2 million largely will be financed through sales of $1.5 million City of Dallas municipal bonds assigned to the company. This will be repaved over 15 years. The remainder of the program will be privately financed using no city funds.

To encourage the development, the city signed a 25-year lease with 10-year option to guarantee that corporate and private planes will be permitted to operate on the airport.

First Stage

Grading of the 35-acre site on the southeast portion of the field has begun and pouring of 8-10 inches of concrete over a six-inch gravel sub-base on the 11-acre ramp that will contain Phase One facilities is scheduled to be completed by Dec. 1. On this ramp will be built an 800-ft. x 160-ft. hangar and terminal building, behind these will go a 400-ft. x 80-ft. "Plane-O-Tel" storage hangar capable of taking Lodestar-size aircraft.

Nucleus of the large hangar area is already operating. Southwest moved its 120-ft. x 160-ft. aircraft shop across the airport to the new location and concrete will be poured around it while the service facility operates, one end being left accessible during the paving. By year's end it will be joined by a storage hangar still operating at SAC's present facility on the south side of the field and two additional storage hangars costing approximately $423,000. Some of the 128,000 sq. ft. of subdivided structure will be high enough to take Convair-size aircraft. Agreements with tenants permit them to do their own overhaul work in aircraft storage areas, one has installed air-conditioned shops.

Feeling Department

The two-story $220,000 business aircraft terminal building will feature a free-hanging stairway. Included will be a pilot's lounge, flight operations department, car-rental office, executive offices for company personnel and headquarters for the firm's fast growing fueling department. The second floor will contain a lounge and dining area—the space readily convertible for meetings containing audiences up to 100. The dining facility will be leased on a bid basis to an outside operator.

Phase Two will include additional ramp area and a building capable of housing Boeing 707 size aircraft adjacent to the main aircraft storage area, a two-story 30,000-sq. ft. distributor sales and office building and extensions to the Plane-O-Tel.

When the expansion program is completed, Southwest Airmotive will be able to put approximately 200 aircraft under roof and have outside parking area for an additional 200, according to executive vice president Winston Castleberry.

Phase One construction contracts already let include $31,109 to Electrical Contracting & Maintenance Co., Dallas, for underground electrical installations; $28,777 to George Luskie Co., Dallas, for water, sewage and gas networks and $283,650 to Austin Paving Co., Dallas, for grading and pouring of concrete.

Fuel Farm

Southwest recently started operating a $65,000 219,000-gal. fuel tank farm on its new site, capable of supplying 80, 91/96, 115/145 and JP-4 in addition to auto fuel and grades 1100 and 1120 oil. The farm comprises nine 20,000-gal. underground tanks and three 13,000-gal. tanks which can be pumped into SAC's trucks at 250 gpm.

Fuel sales are one of SAC's big items, it sells some four million gallons annually to private planes, airlines and transient military aircraft. It recently signed its sixth annual contract with the Armed Services Petroleum Purchasing Agency to fuel military aircraft touching down at Love Field. One of the provisions of its new contract with the city specifies that SAC can sell fuel anywhere on the airport, preventing anyone else from being up such sales.

Tied into the five-year master expansion plan is a new two-story distributor sales and general office building to house another fast-growing segment of SAC's fixed base of operation. Last



Fire control radar tells . . . / **WHERE TO AIM WHEN TO FIRE!**

All-seeing radar pinpoints the target for these Air Force planes. Whatever armament they carry—guns, rockets or missiles—fire control radar tells them *where* and *when*. It provides the far-sighted vision necessary for modern long-range combat operations.

Today's modern fighter plane is an electronic wonder, with fire control radar-computer systems supplying a continuous flow of information about target position in terms of range and rate of closing.

RCA is a major supplier of airborne fire control equipment to the Armed Forces. It has produced, and in several instances developed, these systems for many of the latest aircraft. Some of these are illustrated above.

RCA

Defense Electronic Products

RADIO CORPORATION of AMERICA

Camden, N.J.

year this division moved about $2 million worth of manufacturers' equipment for which it is representative; this year sales are expected to be about $1 million higher, Executive Vice President George W. Jalonick, III, noted. Southwest stocks and distributes parts for nearly 20 manufacturers with a territory basically covering Colorado, Kansas, Missouri, New Mexico, Oklahoma, Arkansas, Texas and Louisiana.

Jalonick is credited with cracking the tough airline market as regards distributor sales. He did this by taking a team into American Airlines and spending nine months and $50,000 studying its books and all phases of its parts replacement problems. Currently, some 70% of SAC's parts sales are to airlines, the remainder to business and private fliers and other fixed base operators. It now services 14 airlines with equipment, maintains inventories for a dozen of these. American Airlines relies on the company for engine accessory parts and equipment, instruments, autopilots and parts, ignition analyzers and spark plugs.

The division also supplies SAC's aircraft service department, which carries approximately $1 million inventory.

Southwest Airmotive's 100,000-sq ft engine overhaul plant on the airport's north side remains unmoved. The jet engine overhaul facility, which is currently turning out seven Allison J33-A-35s daily for USAF also stays unchanged. Southwest is the only fixed base operator doing jet overhauls, it has completed 1,200 J33s, recently was awarded an extension contract for approximately 1,400 additional turbojets valued at over $3 million. This $1.5 million operation, including turbojet test plant, is capable of major overhauls on jets up to the J47 with afterburner.

Civil Aircraft Exports Increase During July

Civil aircraft exports, planes weighing 6,000 lb and less, during July totaled 65 units valued at $1,057,145, the month's shipments being a 30% increase over July 1955.

Total shipments for the first seven months of this year were 508 aircraft valued at $6,295,937 compared with 404 units worth $4,941,808 in the same period last year.

Comparison of General Aviation Accidents by Kind of Flying and Type of Accident 1954-1955

	Accidents				Injuries				Damage			
	Total		Fatal		Fatal		Serious		Destroyed		Substantial	
	1954	1955	1954	1955	1954	1955	1954	1955	1954	1955	1954	1955
Kind of Flying												
Instructional												
Dual	136	107	11	8	20	15	15	10	25	19	111	85
Solo	512	503	53	26	69	37	44	29	109	80	397	419
Non-Commercial												
Pleasure	1,693	1,609	200	190	366	330	194	193	401	380	1,273	1,210
Business	280	347	25	46	40	83	24	25	50	80	228	265
Corporate	77	46	7	3	21	7	7	3	9	5	67	39
Other	75	90	9	9	12	15	20	11	31	22	43	68
Commercial												
Passenger	77	74	11	9	35	20	16	7	21	18	53	56
Cargo	19	15	3	3	5	4		1	6	6	12	9
Ferry, Test, Experimental	53	56	5	9	5	13	4	1	8	16	43	40
Other	47	42	8	5	18	6	6	6	18	11	28	31
Public												
Federal	18	17	2	1	7	3	1		5	2	13	15
Municipal		1										1
State	7	5	1		1		3	3	2	3	5	2
Miscellaneous	41	36	6	9	11	11	4	6	11	22	30	13
Total	3,035	2,948	341	318	610	544	338	295	696	664	2,303	2,253
Type of Accident												
Groundloop	413	434	1		1		2	6	21	25	390	408
Wheels-up Landing	139	124					1		1	1	138	124
Hard Landing	223	195		1		3	5	4	8	8	215	187
Wing Tip Landing		2										2
Collapse/Retraction Landing Gear	99	86						1		1	99	85
Undershoot	196	214	15	15	20	19	23	42	45	47	131	167
Overshoot	181	197	1		1		4	4	16	10	185	187
Nose Up or Over	272	221					2	3	8	7	264	214
Mid Air Collision	14	18	8	4	16	7		2	8	3	4	12
Other Collision Between Aircraft	55	42	1		2		2	1	3	3	40	24
Collision with Trees, Fences, etc	666	657	44	43	69	75	61	59	144	145	522	512
Collision with Ground or Water	84	112	38	71	68	115	25	17	57	80	27	32
Spin or Stall	562	508	191	142	347	234	197	140	329	271	233	237
Fire on Ground	10	4							7	3	3	1
Fire/Explosion in the Air	9	1	2		6		2		7		2	1
Airframe Failure	21	36	16	28	41	67		2	16	29	5	7
Abandoned Aircraft	1	2							1	2		
Miscellaneous	71	85	13	5	13	8	14	14	13	19	38	53
Undetermined	19	10	11	9	26	16			12	10	7	
Total	3,035	2,948	341	318	610	544	338	295	696	664	2,303	2,253

Source: Civil Aeronautics Administration

From Hats... to Helicopters

From the haberdashery business to the helicopter business in 60 days was the transition made by Capt. Kenneth W. Holzer of Russell, Kan., in the early months of the Korean conflict.

So thorough and efficient is the U. S. Army's pilot training that Capt. Holzer, who began a rotary wing course in March 1952, graduated May 1 and in August of the same year was flying helicopter missions in Korea as an artillery spotter.

On one of his reconnaissance missions in a Bell H-13 helicopter, he helped restore critical lines of communications by dropping ropes from the air and hauling a torn away temporary bridge back to shore.

Capt. Holzer is now an Army career pilot, helping to maintain the high standards of rotary wing indoctrination for aviation cadets at Fort Rucker, Ala., the Army's Aviation Training Center.



CAPT. KENNETH W. HOLZER
"...teaches 'Copter Cadets"



A combination of the best pilots, equipment and maintenance gives the Army a new aerial dimension of mobility and flexibility. Capt. Holzer demonstrates in photo how critically needed supplies can be transported in the shortest possible time by helicopter.

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BELL Aircraft corp.

TEXAS DIVISION
P. O. Box 482
FT. WORTH, TEXAS



BUSINESSMEN in South America are getting 47J demonstrations during its extensive tour.



PLUSH CABIN marks passenger version of 47J. Three people sit behind pilot who has good visibility through nose bubble.

Bell Model 47J Helicopter Designed To Give Executive/Utility Service

Hurst, Tex.—The Model 47J executive/utility helicopter is a member of a new family of basic rotary wing aircraft planned by Bell Aircraft Corp.'s Helicopter Division to give the company market coverage in all phases of the market from the smallest to the largest types.

Next step up in size from the 47J probably will be a seven place civil version of the turbine-powered XH-40. Bigger aircraft in the class of the Vertol H-16 also are being considered to fill out the sales line, Bartram Kelley, chief helicopter engineer told AVIATION WEEK. He noted that the XH-40 is being built to pass Civil Aeronautics Administration certification requirements.

Sales Climbing

Civilian helicopter sales are climbing steadily, he stated. Bell has sold the same number of units in the first three quarters of 1956 as it sold all last year, expects unit sales to be more than 30% over 1955. This will be the first year since the Korean War that civil 47-model production will equal military 47-model output. A 400,000-sq.-ft. expansion is going onto the present plant here to provide area for production of Bell's new metal rotor blades, centralization of painting facilities and additional space for the firm's studies of what it terms ideal helicopter instrumentation.

Next year will be the company's biggest commercial helicopter production year, the quota for 1957's civil rotary wing aircraft output now is about 100% more than was authorized by Bell for production and sale on this market in 1956.

Buildup for 47J

Bell helicopter lines are now rolling on Navy HUL-1s, military version of the new 47J. It has started taking orders for the 47J, which is priced at $63,750, and will start deliveries the end of this year or early in 1957. Production of components is underway; shop orders authorizing work on 208 Model 47Js are being handled. The first 50 will have wood rotor blades, later aircraft will have the new all-metal blades developed by Bell as the result of a study for USAF.

It looks as though the new model will be the most successful yet of the company's helicopters, firm inquiries on the 47J totaled approximately $3 million before announcement of price. How much of this initial interest will be translated onto signed contracts remains to be seen, but Kelley stated he had never seen such advance favorable customer reaction by business aircraft prospects on previous models.

In addition to its having approximately one-third more cabin area than the previous model and its greater utility, the 47J shows considerable improvement in handling qualities, probably due to its larger main rotor, which is

Bell 47J Specifications

POWER:			
Powerplant			Lycoming VO435-21
Takeoff Power			260 HP at 3,400 rpm.
Continuous Power			250 HP at 3,200 rpm.
Derated Power			220 HP at 3,200 rpm
WEIGHTS:			
Empty Weight			1,538 lb
Basic 4 Place Configuration			2,452.3 lb.
Litter Evacuation			2,342.3 lb.
Search and Rescue			2,002.4 lb
Staff Liaison, 3-Pace			2,475.3 lb.
Cargo Version			2,565 lb
Long-Range Ferry (600 Nautical Miles)			2,347.3 lb
Gross Weight			2,565 lb
PERFORMANCE:			
	1,942 lb.	2,452 lb	2,565 lb.
Maximum Speed at Sea Level	105 mph.	105 mph	105 mph
Optimum Cruise at Sea Level			
At 75% HP. at 3,000 RPM	98 mph.	89 mph.	87 mph
Time to Climb to 5,000 Ft	3.8 min.	5.7 min	6.3 min.
Absolute Ceiling, Standard Day	10,000 ft.	15,300 ft	14,500 ft
Service Ceiling, Standard Day	18,400 ft.	13,850 ft.	13,050 ft.
Hovering Ceiling, In Ground Effect, Standard Day	14,700 ft	8,550 ft	7,350 ft

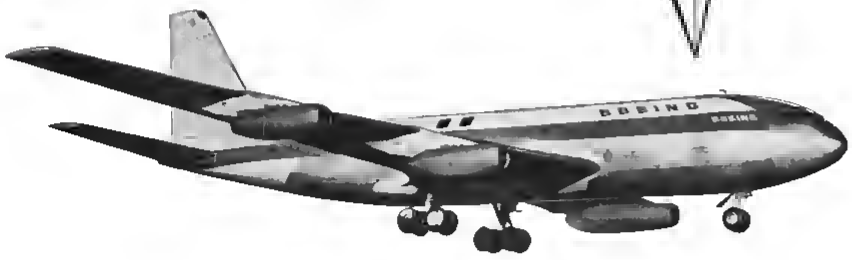
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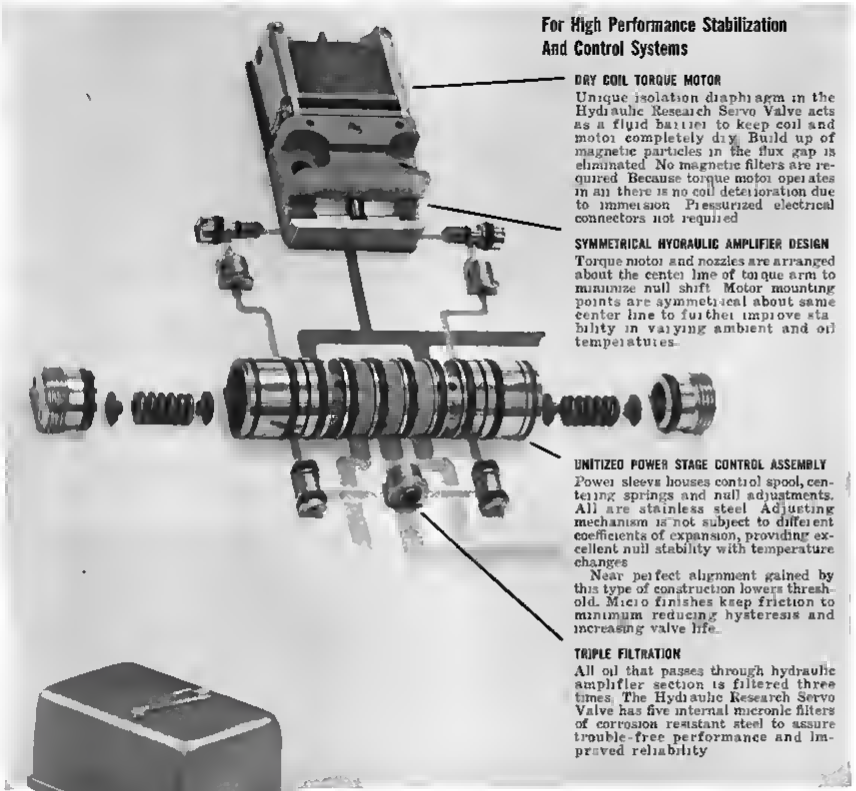
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Unique isolation diaphragm in the Hydraulic Research Servo Valve acts as a fluid barrier to keep coil and motor completely dry. Build up of magnetic particles in the flux gap is eliminated. No magnetic filters are required. Because torque motor operates in air there is no coil deterioration due to immersion. Pressurized electrical connectors not required.

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Torque motor and nozzles are arranged about the center line of torque arm to minimize null shift. Motor mounting points are asymmetrical about same center line to further improve stability in varying ambient and oil temperatures.

UNITIZED POWER STAGE CONTROL ASSEMBLY

Power sleeve houses control spool, centering springs and null adjustments. All are stainless steel. Adjusting mechanism is not subject to different coefficients of expansion, providing excellent null stability with temperature changes.

Near perfect alignment gained by this type of construction lowers threshold. Micro finishes keep friction to minimum reducing hysteresis and increasing valve life.

TRIPLE FILTRATION

All oil that passes through hydraulic amplifier section is filtered three times. The Hydraulic Research Servo Valve has five internal micronic filters of corrosion resistant steel to assure trouble-free performance and improved reliability.



The Hydraulic Research Dry Coil Servo Valve is available in quantity for high performance flight and control systems. *Write for additional engineering information.*

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CHALLENGING ENGINEERING POSITIONS OPEN

37 ft. 2-in. diameter compared with the H's 35 ft. 1 in.

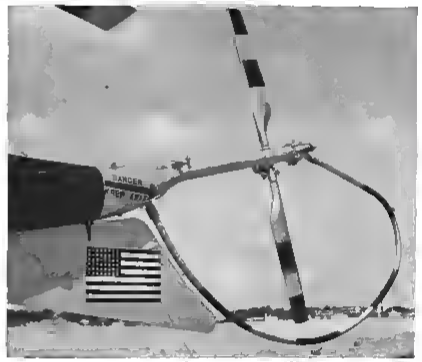
The Model 47H, which actually was a "trial-horse" to test the corporation market and meet demands for plush aircraft indicated there was a strong sales potential for an executive helicopter, its three-place capacity and the fact that it was limited in utility slowed its potential. All 47Hs have had custom interiors. The four place 47J with plush interior quickly convertible to a variety of utility roles, will exploit the field more capably. A major factor in the decision to develop the new model and get it onto the civil market quickly is Cessna's new four place CH-1, which will be competing with the 47J in 1958.

Bell will phase out the 47H early next year, although it will maintain sufficient components to assemble aircraft on a 60-days-after-order delivery basis. About 35 47Hs will have been produced by time it is out of production.



THREE ASSEMBLY LINES turn out HSL (left), HUL-1 (47J), center, Army HTL-6 (H-13), right.





BAGGAGE COMPARTMENT measures 25 in. x 29 in. x 35 in. Improved tail rotor pitch control (right) features chain-and-sprocket drive eliminates cable fraying encountered with former drum having threaded grooves in which six or more cable turns traveled.

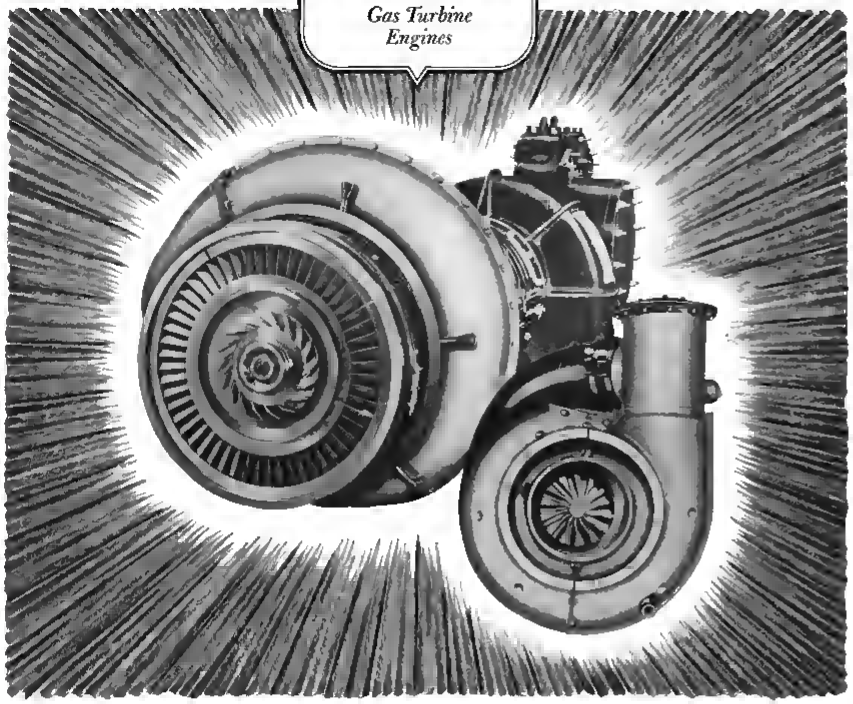




WRITING PANEL is attached to refreshment bar (left). Internal electric hoist (right) is located for easy pilot operation.

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Modified DC-3 Tops 225 Mph.

First flight photo of DC-3 extensively modified by Aircraft Conversion Corp., Detroit, Mich., which claims that its Challenger 250 has a high speed range of 225-240 mph. Powerplants can be either P&W R1830-94 or R2000 series. Cia Mexicana de Aviacion has flown the first of 17 DC-3s to Detroit for conversion to Challenger 250 configurations. Aircraft Conversion Corp. reports. Conversion costs about $30,000.

U. S. BUSINESS & UTILITY AIRCRAFT SHIPMENTS

(January—August 1956)

Make and Model	Aircraft		Builder's Net Billing Price	
	August	Jan.-July Total	August	Jan.-July Total
Aero Design 560-A 680	N. A.	36 44	N. A.	$5,768,700
Beech 35 Bonanza E18S Super 18 D18S 50 Twin-Bonanza Model 45 Trainer	43 10 0 11 0	501 63 6 82 50	$2,560,749	18,063,749
Collair A-4	2	13	11,000	60,720
Comair 460 Twin-Navion	1	11	35,690	293,450
Cessna 170 172 180 182 310	0 106 61 68 27	70 959 353 596 140	3,533,348	23,940,147.35
Champion 7EC	21	116	87,575	451,626.46
Colonial C-1 Skimmer	2[1]	0	34,000	0
Helio H-391B Courier	2	17	46,000	392,000
Lear Learstar Mk. 1 Learstar Mk. 2	1 0	3 0	400,000	1,846,000
Meaney M18C M20	0 8	9 36	82,000	412,606.55
Piper Super Cub PA-18 Super Cub PA-18A Tri-Pacer PA-22 Apache PA-23	27 34 117 57	130 305 711 240	2,509,350.10	14,758,710.94
Royal Gull P-138LT	2	10	149,000	670,000
Taylorcraft Model 20	4	23	36,000	199,853.80
Totals	626	4,538	$9,674,712.10	$66,867,675.20

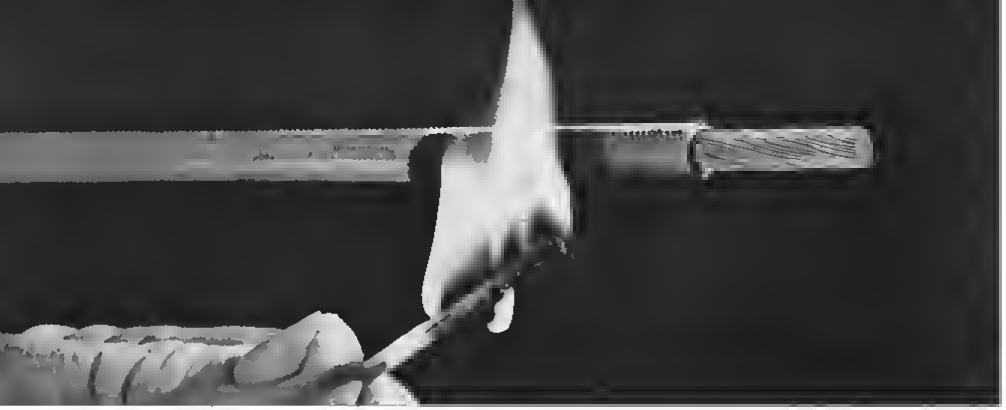
[1] Initial deliveries of production airplanes by Colonial Aircraft Corp., Sanford, Me.
N. A. Not Available.

Source: Compiled by AVIATION WEEK.

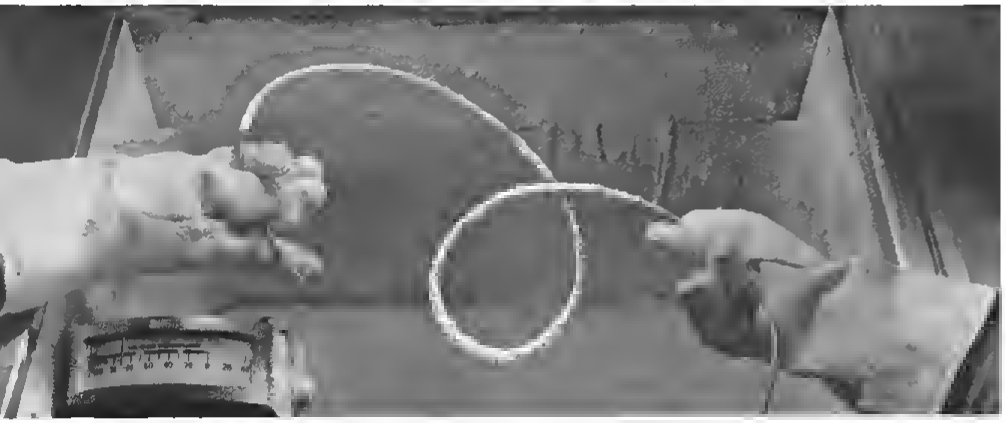
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Packard PE-400 will withstand prolonged operating temperatures up to 500° F. Flame will not destroy its effectiveness. It is not affected by any of the fuels or chemicals used in aircraft operation.

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Packard PE-400 is made to greatly exceed the requirements of military specification MIL-W-7139. This outstanding cable gives high abrasion resistance and its construction provides a hermetic seal against moisture and chemicals.

You can print on the uniform, smooth coating and the cable is available in solid colors and in white with colored tracers. Facts are available that prove conclusively Packard PE-400 is unequalled by any other cable of its kind! Ask for it today. Packard Electric maintains offices in Detroit, Chicago, and Oakland, California, for your convenience.

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PRIVATE LINES



FLYING PAYMASTER Clyde Jordon (lower right) prepares to step from one N. Y. Trap Rock Co. barge to another to distribute bi-monthly payrolls, having landed on one of the company's barges in a Bell 47G helicopter. Every two weeks he makes the aerial tour of barges and quarry plants from mid-Manhattan New York offices as far as 85 mi. up the Hudson, covering the route in one day. Company executives also use the Bell for fast transportation between main offices and upriver plants.

Periodic inspection of nose landing gear on executive Douglas B-26B and B-26C airplanes is required by CAA Airworthiness Directive 56-18-3 as a result of numerous cases of cracks being discovered in the cross beam assembly. The inspection includes: Remove cross beam assembly P/N 5280335, or 5280336, 5123942, 5123943 and inspect with magnetic particle, dye penetrant or X-ray the five-inch outboard portion of the beam and trunnion assembly for cracks. Measure from the trunnion journal inboard and particularly check the area around the trunnion's shoulder and inboard of the welded area of the strap. Cracked cross beam assemblies must be replaced.

Cessna has made a number of studies of a business-plane version of its twin-jet T-37A trainer, which the company is now producing for USAF. Because of production know-how, a civil T-37A could be marketed at attractive prices, industry observers say.

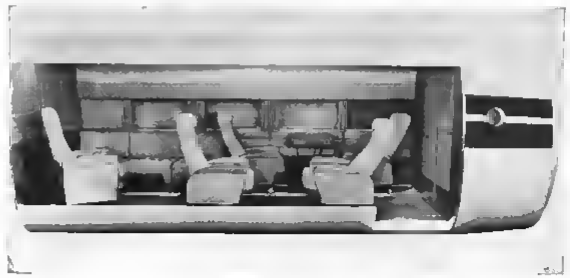
A southwestern engine overhaul base is quietly preparing to enter the jet engine overhaul field. Currently, the only fixed base jet engine overhaul facility is operated by Southwest Airmotive Corp., Love Field, Dallas, Tex.

U. S. Steel Corp. ordered its third Learstar Mk. 1 business transport which, like its two present planes, will be fitted with weather radar. New airplane will have fuel capacity increased from 1,125 gal. to 1,350 gal.

Increase in business flying in Alabama area is indicated by expected fuel consumption in that state of 4 million gallons this year, double the 1951-1952 figure.

Doman LZ-5 eight-place helicopter is undergoing a sales demonstration tour in Europe.

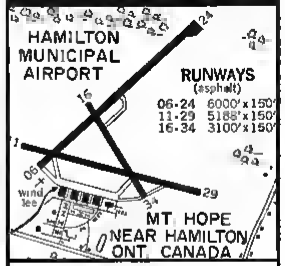
Mooney delivered its 50th Mk. 20 and expects soon to be turning this



NBAA To See Cessna 620 Cabin

Furnished cabin mockup of Cessna Model 620 four-engine pressurized business transport will be displayed in Miami during National Business Aircraft Assn.'s ninth annual forum Oct. 23-25. Shown here is eight passenger configuration with sleeper-type seats. They are mounted on tracks running full length of cabin having one-inch spaced tiedowns allowing easy re-arrangement. At right are doors leading to 50-cu.-ft. baggage compartment on right side of cabin; restroom is on left.

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Now, precious space, weight and power can be saved in aircraft construction when the design allows for the use of this new radio marker beacon receiver.

By using sub-miniature components and techniques, Stromberg-Carlson is now producing for the U. S. Air Force a receiver measuring 79 cubic inches in volume (compared with 308 in previous models), 3.9 pounds in weight (compared with 10.5), and requiring 15 watts power (compared with 40).

This new receiver (the AN/ARN-32) is easier to maintain because of the quick accessibility of its components. For example, the bottoms of tube sockets and wiring are easily reached from the outside.

In addition, the receiver is designed for unusually stable sensitivity and frequency.

Operating directly from the aircraft's 28-volt electrical system, the new receiver is effective at altitudes of 50,000 feet and at a temperature range of −68° to 160°F. It meets all Armed Forces requirements for resistance to shock and humidity.

This highly specialized equipment is one more example of our role in the defense of our country in partnership with military aviation.

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S-C

four-place business planes out at a rate of one-a-day.

Four helicopters, probably Bell types, will be purchased by a Lebanese firm based in Beirut to provide charter service to oil companies, rescue and passenger, mail and freight operations. The firm plans to begin flying the helicopters this year.

Czech national factory, Orlican in Choceň, is producing the L-60 Ceteka for agricultural duties, following successful tests of prototypes. First production model is going to Argentina.

Electrically heated windshield with its own power system has been installed in Libby-Owens-Ford's DC-3 by AiResearch Aviation Service Division, Garrett Corp.

Northern Aircraft Co. is new Aero Commander sales outlet in Northern California, Northern Nevada, Oregon.

Dow Chemical Co., Midland, Mich., is operating a DC-3 recently converted by Remmert-Werner, Inc., St. Louis, Mo. Plane has Bendix X-band radar, Sperry A-12 autopilot, Collins 51R3 omni with radio magnetic indicator and integrated flight system, Collins 17L-51X vhf 360-channel communications, Collins 51Z marker and 51V2 glide slope receivers. R/W estimates that there are now over 2,000 all-weather multi-engine aircraft from Beech D18 sizes and up being operated by U. S. businessmen.

Funk Aircraft Co. has completed a new, larger plant replacing the one destroyed by fire at 1211 W. 12 St., Coffeyville, Kan.

First Aero Commander 560-A delivered to Europe is being used by Buchdruckerei Carl Meyer, Zürich, Switzerland, publisher.

Dallas Aero Service, Love Field, Tex., is licensed to install Airline Training, Inc.'s Beech D18S speed kit, which is reported to increase the plane's speed by 20 mph. and range by 10%. Takeoff critical altitude is reported to be increased from 2,400 ft. to 3,850 ft.

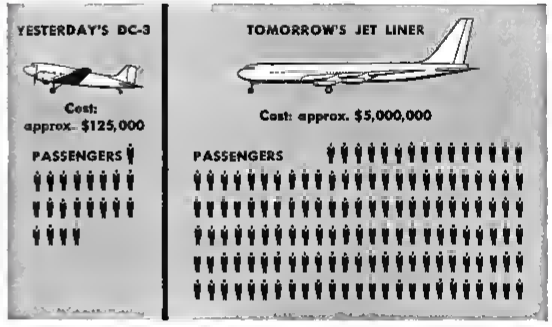
New distributor for Lycoming engines and parts is Brown Aero Corp., Love Field, Dallas, Tex.

Helicopter and repair facility is being operated under supervision of Sikorsky Aircraft Division, United Aircraft Corp., at Bridgeport (Conn.) Airport. New unit has its own receiving, shipping, inspection, materials control and production planning groups.

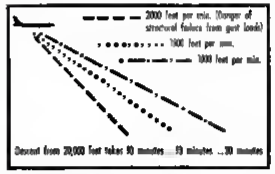
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P&W Forum Studies Engine Performance

By George L. Christian

Millville, N. J.—Highlights of the seventh Pratt & Whitney Airwork Operation and Maintenance Forum held recently included discussion of engine problems imposed by helicopter operation, favorable results of oil filters, adverse effects of detergent oils and general spark plug experience.

During the meeting a former star of the annual forum (AW Sept. 26, 1955, p. 75)—the Hi Per DC 3, a faster better performing, R-2000-powered version of the old Douglas workhorse—was eclipsed by Jato-powered corporation planes.

Demonstration takeoffs with and without Jato by a PV-1 owned by Rockwell Manufacturing gave a convincing demonstration of how Jato can boost a twin-engine aircraft—with the right engine windmilling—out of a precarious position if the engine quits as the plane leaves the runway. Without Jato the plane barely struggled to an altitude of 75 ft.; with the rocket assist, the plane climbed handily to 570 ft.

Engines & Octanes

P&WA, co-sponsor of the forum with Airwork, sent several specialists to form a panel which discussed various phases of engine operation as it concerns private operators and answered any questions asked of them by the audience. The forum was attended by some 130 representatives of corporate aircraft owners and pilots, aircraft parts distributors, airlines and government officials.

Among the more pertinent points brought out in the discussions and question and answer period were:

Lean mixture is better for engines during ground operation than auto rich.

However, P&WA has consistently recommended using auto rich because the company is so afraid that pilots might forget to move the mixture control to auto rich for takeoff. As a P&WA spokesman said, "if the mixture control were left in the lean position, we seriously doubt if a pilot could get his plane off the ground."

The cooling efficiency of metalized cylinders is better than that of black-painted cylinders. The black paint was used on old-type steel barrel cylinders to protect them from corrosion.

The P&WA R-2800 series engine is particularly fussy concerning what spark plugs can be used in it and what gaps exist between the points. This is particularly true of the engine operating under "wet takeoff" conditions, when plug gaps cannot exceed .020 in.

P&WA recommends using plugs with two heat ranges in the R-2800. (At least one operator uses three different heat range plugs in his R-2800s). The engine maker suggests that cold plugs be used in the rear position of all front row cylinders, hotter plugs in all other positions.

The temperature spread on R-2800 plug positions is cut down 20% by a Douglas Aircraft kit which uses a spinner and cowl seals to achieve the temperature levelling effect. The installation is designed for DC-6 and CD-6B type aircraft.

P&WA underlined the fact that master rods were a much more critical item on engines used in helicopters than on identical engines mounted in fixed wing aircraft. Reason is that in a helicopter the engines are operated at least part of the time at high rpm and low manifold pressure—as during approach conditions. The low manifold pressure eliminates the "cushion" which helps to stop the piston as it reaches top dead center and there is no manifold pressure to help its downward trip. Result is that unusually high stresses are induced in all rotating parts, especially link and master rods.

P&WA believes the R-985 (450 hp. for takeoff) is the only engine of its size on which it is permissible to operate at full takeoff power continuously.

If too low cruising power is used on the Twin Beech, cylinder head temperatures may get too low and the aircraft may become too sluggish and sloppy on the controls.

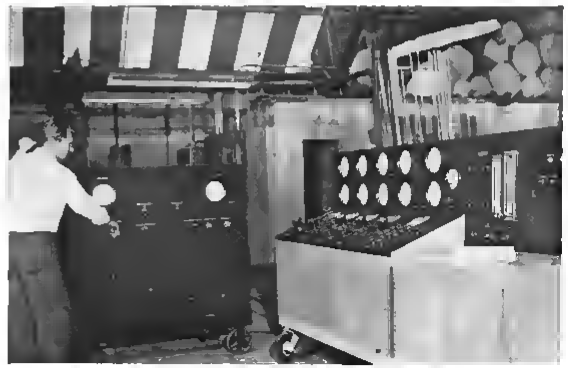
Backfiring through the induction system may be due to temporary reverse flow of exhaust gases when the throttle is suddenly chopped. Reason is because of valve timing overlap, and the phenomena is most apt to occur with short exhaust stacks.

Filters & Oils

P&WA spokesmen said that their company highly endorses the external oil filtration on aircraft engines. The filters are made by Fram (AW June 22, 1953, p. 74) and Winslow (AW May 23, 1955, p. 66). Added weight and expense of the installation are to be considered, says Pratt & Whitney.

While detergent oils give good results in small aircraft engines, they are not to be used in large, R-2000 and R-2800 size powerplants, according to P&WA.

The engine maker says it has tested many detergent oils and all have shown some adverse effects on engine operation. Most common are corrosive action on the lead-indium bearings used in the engines, bearing failures induced



Rocket Test

Test stand (left) checks operation of highly complex pneumatic and electric test stand (right) used to check out big rocket motors without actual firing. Both stands are made by Lear for Rocketdyne Division of North American Aviation.

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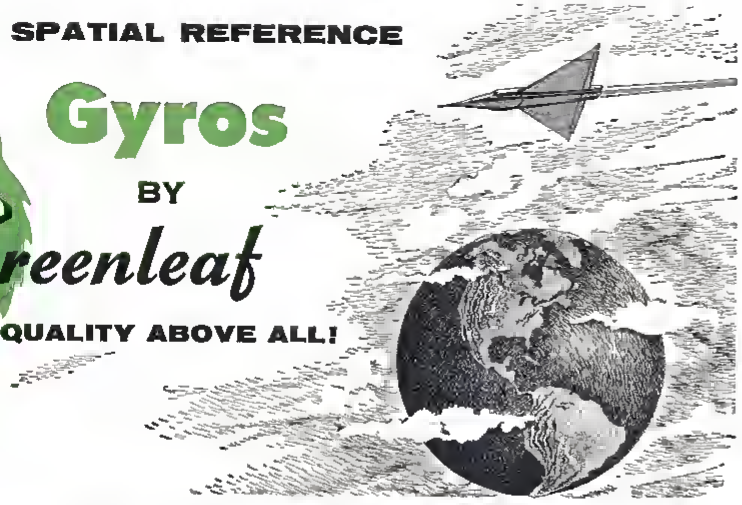
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Gyros

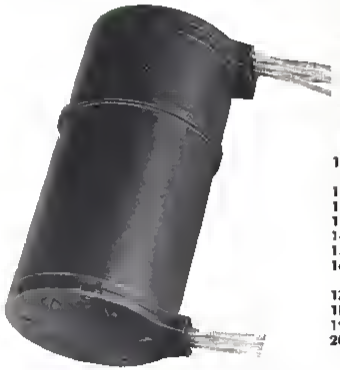
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13. Characteristic Time Constant: 0.0024 seconds
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15. Output Angular Rate, Input Angular Rate Ratio: 1.0
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by excessive oil foaming and resultant poor lubrication, and ash-type deposits in the combustion chamber, setting the stage for pre-ignition.

However, the company is willing to test any new detergent oils as they are produced.

One of the P&WA representatives added that one detergent oil—called Miracle Power—has been approved by his company.

P&WA technicians emphasized that, by detergent oils, they meant oils whose detergents were added at the refinery by the oil company under carefully controlled conditions. They were unanimously against "moose milk" additives which were put into the oil in the field under uncontrolled conditions.

Generally speaking, P&WA is against using re-refined oil because, if the oils come from several different crudes, "you don't know what kind of lubricant you will get." However if each batch of re-refined oil is made from the same type of crude, the resulting oil can be perfectly satisfactory.

John S. Gillespie, vice president for sales closed the forum with these comments about Airwork.

The company stresses three points. Giving its customers safety resulting from the highest possible quality, economy, and service after the sale.

He underlined the fact that the first cost, or overhaul charge of an engine, is not the final cost. The final cost includes any repairs and failure corrections which have to be made during the lifetime of an engine. Therefore, high quality, which has a high first cost, pays for itself many times over when spread out over the engine's final cost per hour.

He concluded by noting that Airwork is expanding its service group to give its customers the best possible service.

WHAT'S NEW

Publications Received

• *National Security and International Trade*—A Report of the Committee On Commercial Policy—Pub. by the United States Council of the International Chamber of Commerce, Inc., 103 Park Avenue, New York 17, N. Y.—Available through the United States Council, 103 Park Ave., New York 17, N. Y.. $ 30. 32pp.

This study compares the effect on national security of the alternative policies of exposing essential industries to international competition or protecting them by restricting imports.

• *Public Utility Regulatory Law*—by Everett C. McKeage—Pub. by the Vantage Press, Inc., 120 West 31st St., New York 1, N. Y. $5.00, 107pp.

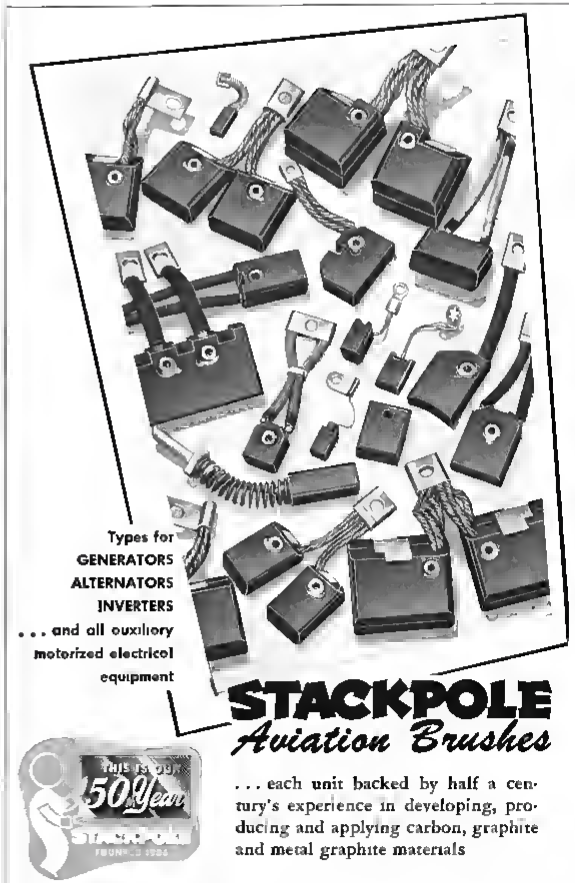
The author, a recognized authority in this highly specialized field, presents seven articles on the specific problems of public utility regulatory law, including a treatise on "State Regulation of Air Carriers."

• *Weather Analysis and Forecasting*—Vol. I, Motion and Motion Systems—by Sverre Petterssen—Pub. by Mc Graw-Hill Book Co., 330 West 42nd St., New York 36, N. Y. $8.50, 428pp.

• *Atoms and Energy*—by Professor H. S. W. Massey F.R.S.—Pub. by Philosophical Library, Inc., 15 East 40th St., New York 16, N. Y. $4.75; 174pp.

Clearly and concisely written, this book gives a non-technical account of the developments in atomic physics which led up to the large scale release of atomic energy.

• *Properties of Combustion Gases/System* C_nH_{2n}—Air—in two volumes: *Thermodynamic Properties*, and *Chemical Composition of Equilibrium Mixtures*—by the Aircraft Gas Turbine Development Department, General Electric Company, Cincinnati, Ohio—Pub. by McGraw-Hill Book Company, 330 West 42nd St., New York 36,



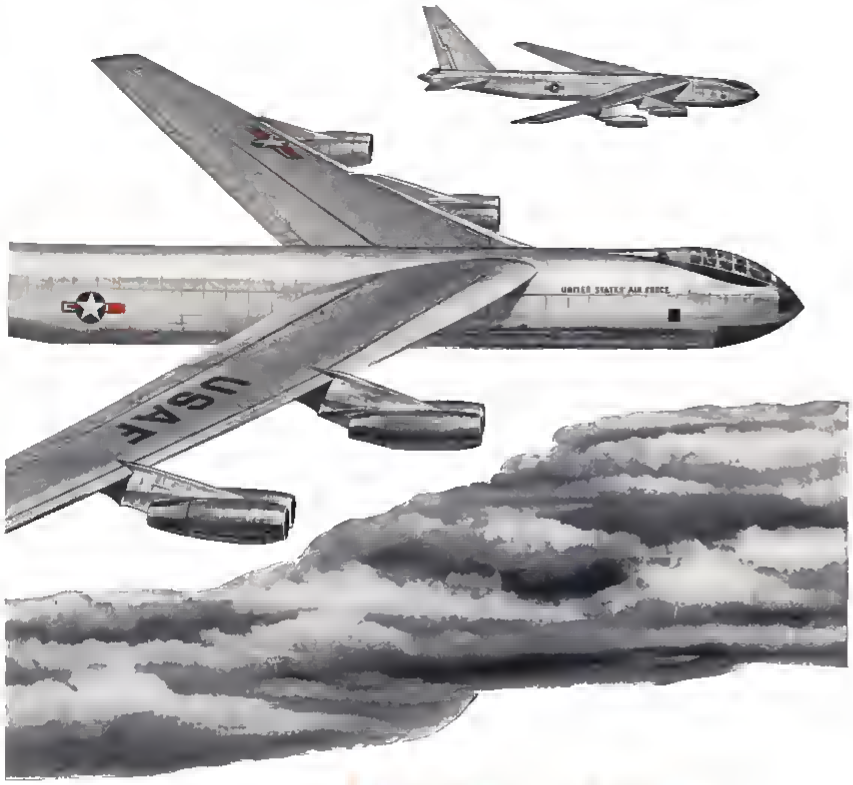
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N Y $75 00, Volume 1, 377pp., Volume II, 677pp

Comprised wholly of tables with brief introductory text, these volumes provide an accurate knowledge of the thermodynamic properties and behavior of the working fluid of the air-breathing combustion engine under very wide ranges of operating conditions, and will contribute to a fuller realization of the performance levels which are becoming practicable for air breathing jet propulsion systems The tables are applicable to the combustion gases of any hydrocarbon fuel with a hydrogen to carbon ratio of two, independently of the fuel's chemical make-up or heating value

• *Planes Editorial Index, January 1952 June 1956*—Pub by Aircraft Industries Association of America, Inc , 610 Shoreham Building Washington 5, D C 39pp

Titles of articles are listed in the index by month and year and alphabetically by category

• *A Manual of Processes for the Cold Bending of Metals and Abrasive Cut-Machining of Metals*—Prepared and published by Wallace Supplies Manufacturing Company, 1300 Diversey Parkway, Chicago 14, Ill $2 50, 170pp

This is a four section manual on the cold bending of metals by the described and suggested processes, and on methods of cut-machining metals

• *ASTM Standards on Engine Antifreezes*—Pub by, and available from, American Society for Testing Materials Headquarters, 1916 Race St , Philadelphia 3, Pa $1 50, 52pp

A compilation of all ASTM methods of tests pertaining to engine antifreezes, this handbook containing 11 standards—9 test methods and 2 specifications—should be of considerable interest to both producers and consumers of engine anti-freezes

• *ASTM Manual for Rating Motor Fuels by Motor and Research Methods*—Pub by and available through, American Society for Testing Materials Headquarters 1916 Race St., Philadelphia, Pa $6 75, 180pp

Liberally illustrated, the manual should enable qualified personnel to install and operate knock testing equipment for both the motor and research methods



Automatic Baggage Diverter

This automatic baggage-handling system for airport terminals diverts in-coming baggage down a metal ramp into waiting passengers' hands. The device, which can handle 130 bags in two minutes, is called a baggage diverter and was developed by United Air Lines. Machine consists of two conveyor belts about 60 ft long Running parallel with each belt is a diverter—a small cart with an arm which automatically shunts bags off the belts at two foot intervals passing them on to the metal ramp The diverter incorporates a photoelectric cell When its beam is broken by an incoming piece of luggage, the diverter's arm directs the bag onto the diverter's auxiliary conveyor, whence it slides down the metal ramp. Initial system was installed at Los Angeles International Airport UAL plans similar installations at other major terminals.

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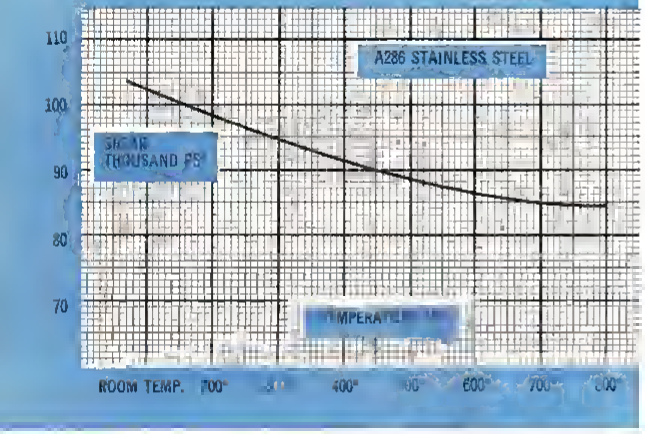
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conium arclight is used because of the proximity of fuel fumes. The low voltage power supply can be connected to a 115 v.a.c. source 30 ft. away. The periscope weighs 15 lb., is 30 in. long and has a viewing head diameter of 2⅜ in.

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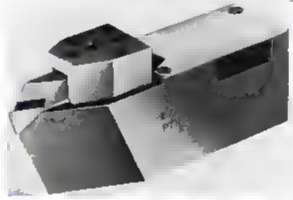
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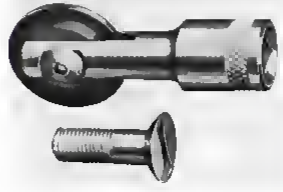


claimed: neutral or positive rake permits faster metal removal without increased power, infinitely adjustable carbide faced chip breaker gives positive action at any speed or feed, solid carbide 3½ in. long triangular tool bits are available in all qualities from leading manufacturers, and any nose radius and any lead angle may be used making it unnecessary to design parts to fit tooling.

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New type of recess for screws, bolts, blind bolts, cowl fasteners, etc. used with a discus shaped driving blade delivers torque values at least twice those required for all fastener sizes usable with a driver of a given size. Slot is undercut on both sides, the bottom





The first of a new aircraft type—the Martin SeaMaster depends on Cherry Rivets for quality fastening

The U. S. Navy's first multi-jet attack seaplane, the Martin XP6M-1 SeaMaster, gives military strategy a flexibility and mobility never before possible with military aircraft. It has global range, is capable of speeds over 600 miles per hour and will cruise normally at 40,000 feet. The plane is as big as a commercial airliner, yet it can operate from the seaways, lakes and rivers of the world, on extended periods of duty and still be independent of fixed bases. Its two primary missions are mine laying and photo-reconnaissance.

In designing the big, swept-wing flying boat, Martin engineers knew they could depend upon the high quality of Cherry Blind Rivets to provide uniformly good fastening in many intricate places. Their confidence is not misplaced, for Cherry engineers long ago accepted the responsibility of producing the best and widest range of blind fasteners for the aircraft industry.

The attainment of this goal is possible because a continuous quality control program is in effect in the Santa Ana plant which is devoted exclusively to making aircraft products. Every operation, from the inspection of raw material, tools, dies and gages—through machine maintenance, final line inspection and testing, is designed to provide a uniform operation of Cherry Rivets under a variety of applications.

Cherry engineers also have pioneered in developing new and better tools for installing Cherry Rivets which is a service provided to enable aircraft companies to attain more efficient production and lower unit costs.

These are but a few of the reasons why Cherry Rivets are standard in many aircraft plants. For complete information, write Townsend Company, Cherry Rivet Division, P.O. Box 2157-N, Santa Ana, California.

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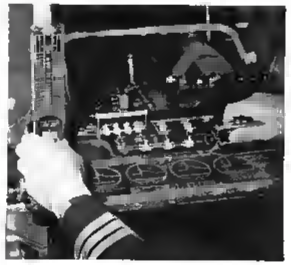
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- ☐ Structural Design
- ☐ Test & Development
- ☐ Thermodynamics
- ☐ Weights

curvature matches that of the driver, and the driving surfaces are parallel to eliminate camming action and transmit full bearing thrust. Also claimed for the new recess are greater head strength, smaller head sizes and positive inward thrust in driving or removal. The shape of the driving blade enables the tool to deliver torque at a wide range of angles. The fastener is now available as National Aircraft Standard High Torque Bolt (NAS 583 through NAS 590).

Blackhawk Mfg. Co., Dept. RE, Rd., Chicago 50, Ill.

Vibrometer

Four ounce Vibrometer measures vibration range from 500 to 10,000 cycles per minute. Unit may be used for engine synchronization. Steel reed is both sensor and indicator. Extension or retraction selects frequency. Amount of deflection measures amplitude at that



frequency. No external electrical or other connections are required and it can be mounted at any convenient point on aircraft structure. Vibrometer may be used for trouble shooting where the exact frequencies of unbalanced rotating components can be determined.

Detroit Corp., 1064 S. Claremont St., San Mateo, Calif.

Liquid Spring

American conceived high velocity liquid spring has been designed to drive ram or act as shock absorber. Taylor Model S1064-6 liquid spring with a preload of 1,000 lb. develops 6,400 lb. of spring action in ¾ in.



stroke. Stroke provides 200 in./lb. high velocity energy output and 10 in./lb. of shock absorption with a total efficiency of 77%. First 90% of stroke is spring and last 10% is shock absorption. Unit is 8 in. long and outside diameter is 1¼ in. Each end has a bearing surface to permit use of the cylinder as a reciprocating mass.

Taylor Devices Inc., 188 Main St., North Tonawanda, N. Y.

ALSO ON THE MARKET

Projection Angle Dekkor (Hilger & Watts) is now equipped with an optical micrometer for direct reading to ½ second. For inspection and production jobs, unit provides a direct means to determine squareness, parallelism, tilt, and change of angle regardless of distance.—Engis Equipment Co., 431 South Dearborn St., Chicago 5, Ill.

Stratopower 54F series hydraulic motors are designed for operation in 3,000 psi system. Units are produced in a range of eight sizes from 0.1 through 1.0 cu. in. displacement. They are suitable for continuous, intermittent or continuously reversing duty cycles; motor may be stalled indefinitely without damage.—New York Air Brake Co., Watertown Division, Watertown, N. Y.

Model 6505A, 400-cycle frequency meter, has overall accuracy of 0.1% or better at all frequencies in its range (370 to 430 cps). Model requires no adjustment for operation from any signal input from 6 v. to 250 v.—Varo Manufacturing Co., Inc., 2201 Walnut St., Garland, Tex.

Microminiature terminal lugs and rivets are designed for compact component packages in instrument, electronic, and printed circuit applications involving space requirements smaller than normal subminiature hardware permits. Items are non-magnetic of precision instrument quality for uniform, trouble-free, reliable use.—Circon Component Co., Santa Barbara Municipal Airport, Goleta, Calif.

Self-locking metal nuts by Con-Torq are guaranteed to be vibration proof and are unaffected by heat or weather. Items are precision-threaded and have crimped ribs on two sides. They can be reused repeatedly without impairing their locking ability and are easily installed with standard tools.—Con-Torq, Inc., North & Judd Mfg. Co., New Britain, Conn.

Series "300" adjustable-speed drive is available in ¼ and ½ h.p. with either geared or ungeared motors. Motor armature delivers a constant torque at a speed from near zero to 2,400 rpm. Concrete-like epoxy resin encapsulates all resistors, condensers, etc. within a single plug-in assembly.—Servo-Tek



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Products Co., Inc., 1086 Goffle Rd., Hawthorne, N. J.

Digital multimeter measures volts and ohms at a rate of 60 readings per second with ±0.5% absolute accuracy. This portable digital VTVM measures positive or negative voltages from .01 to 1,000 volts AC or DC and resistances from 10 ohms to 10 megohms.—Franklin Electronics Inc., Bridgeport, Pa.

Subminax RF connectors added to line are 27-27 hermetic seal panel receptacle 27-28 between series adapter designed to provide a transition between BNC and Subminax, 27-800 printed circuit receptacle, and 27-801 cable termination all have an impedance of 50 ohms.—Amphenol Electronics Corp., Chicago 50, Ill.

Ferristors, miniature saturable reactors consisting of simple wirewound coils on a magnetic core, encased in epoxy resin with four pigtail leads, have been developed to replace vacuum tubes in electronic equipment. Two types are available one for high speed magnetic amplifier applications and another for counting circuits.—Berkeley Division of Beckman Instruments, 2200 Wright Ave., Richmond, Calif.

Single-station, discharge-type vacuum gage gives continuous pressure readings over an extended range from 25 microns to 1 x 10^{-9} mm HG. Unit is 6¼ in. high x 11 in. wide x 6 in. deep, and weighs 12 lb. Operable on 115 v power, it is adaptable to 230 v.—Consolidated Electrodynamics Corp., Rochester Division, 1775 Mount Read Blvd., Rochester 3, N. Y.

Normally closed, small, lightweight standard model **explosive valve** is a tight shut-off valve for long or short time storage of gas or liquid under high pressure, operates instantaneously by firing a small completely contained explosive squib. Item weighs 10 oz., 3 in. pigtails are provided for electrical connections. AN plug or terminal ends are available.—Explosive Products Division, Conax Corp., 7811 Sheridan Dr., Buffalo 21, N. Y.

Model 618-24-100, 8 day, **elapsed time aircraft clock,** has calibrations of ½ and 1/100 second indicated separately on dial. It is made in accordance with MIL-C-9196 (USAF). Unit fits standard panel opening, is available with either 12 or 24 hr. dial.—Wakmann Watch Co., Inc., 15 West 47th St., New York 36, N. Y.

DQT, miniature Teflon insulated solid wire, is available in sizes from 34 AWG to 20 AWG, in eight solid colors.—Hitemp Wires, Inc., Mineola, N. Y.



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CAB Accident Investigation Report

Crash Blamed on Uncoordinated Actions

Trans World Airlines' Flight 400 of April 1, 1956, a Martin 404 N 40403, crashed and burned immediately after take-off from the Greater Pittsburgh Airport on April 1, 1956, about 1920[1]. The hostess and 21 of the 33 passengers were killed both pilots survived. The aircraft was destroyed by impact and fire.

Flight 400 was regularly scheduled between Pittsburgh, Pa., and Newark, N. J., with stops at Harrisburg, Reading and Allentown, Pa. Captain Raymond F. McQuade, First Officer Harlan V. Jesperson, and Hostess Mari Jane Fanning comprised the crew.

Prior to departure the pilots were briefed on the en route weather and received the sequence and forecast reports. Although the enroute weather was generally good the flight was dispatched to Newark on an IFR flight plan via airways as is customary.

Upon departure the gross weight of the aircraft was 41,822 pounds (the certificated allowable takeoff gross is 44,900 pounds and TWA's own limit is 43,650 pounds) and the center of gravity of the loaded aircraft was located within prescribed limits. Scheduled departure time was 1915; the flight asked for and received taxi clearance at 1916, was then given the wind as calm and was cleared to runway 23.

Takeoff clearance was requested and granted at 1919. About one minute later tower personnel observed a seemingly normal takeoff and initial climb immediately followed by a left turning descent, crash, and erupting fire just beyond the southwest boundary of the airport.

Passengers extricated themselves from the jumbled wreckage through and ahead of the fire as best as they could, some helped others while a few found themselves thrown out through tears and rents in the shattered fuselage. Although airport based fire fighting equipment was dispatched with no loss of time some 20 minutes elapsed before it reached the site because of the necessity of traversing circuitous country lanes. Once there, the conflagration, which by that time had nearly consumed the wreckage, was quickly smothered.

INVESTIGATION

The subject aircraft had arrived at Pittsburgh from Newark as TWA Flight 403 approximately one hour and 15 minutes before starting back to Newark as Flight 400.

The crew was the same on both flights and during both First Officer Jesperson was in the left seat being line-checked for captaincy by Captain McQuade, a company-qualified line check captain. Flight 403 was completely routine and no entries (squawks) were made in the ship's log.

While on the ground at Pittsburgh, the aircraft received the usual cleaning and servicing and the terminal check with fuel being added until each main tank held 310 gallons, or a total of 620 gallons.

Runway 23, the one used, is 5,766 feet long and at an elevation of 1,151 msl on the northeast end and 1,126 feet on the southwest end (down gradient in direction of takeoff). Runway lights are of the cone type and were set at No. 3 position (medium intensity) at the time of takeoff. The runway was dry at that time.

Before takeoff the customary pre-takeoff check was made including a check of the functioning of manual propeller feathering and turning on the auto-feathering switch. Engines were run up normally and takeoff from runway 23 followed. First Officer Jesperson on the left, made the takeoff. Both pilots testified that the takeoff was normal in all respects without skip or bounce.

After becoming airborne, a sharp yaw to the left was experienced at the time of the first power reduction by the first officer. Almost simultaneously he saw the left engine No. 1 zone fire warning light flash on and off and then stay on. He did not hear a fire warning bell.

Captain McQuade, on the right, was performing the duties of first officer. Captain McQuade stated that at the time he had operated the gear up handle and was toggling the rpm to the proper engine speed following the first power reduction.

Emergency Checklist

The captain, at the time of feeling the aircraft yaw left, did not see the zone 1 fire warning light nor hear an alarm. However, he did observe a rapid drop to the left BMEP gauge, which went to zero and reached under the right arm of the first officer, then on the throttles, to retard the left engine mixture control to idle cutoff which action is item No. 2 on the emergency checklist under the heading "Power Plant Fire-Failure."

The first officer stated that he then removed his right hand from the throttles and reached for the manual feathering button, whereupon the captain informed him that the automatic feathering device would cause the propeller to feather. Jesperson then, without actuating the feathering but-

[1]All times herein are eastern standard and based on the 24 hour clock.

ALPA Rebuttal

Chicago—Air Line Pilots Assn. issued a rebuttal to the CAB report on the TWA Martin 4-0-4 Pittsburgh accident, contending the report was not supported by the testimony at the hearings.

"The inference of 'pilot error' is completely unwarranted by the facts presented during the hearings," C. N. Sayen, president of the 11,000-member ALPA said. "Immediate action will be taken to see that the facts are given proper consideration and we intend to initiate procedures to request that the CAB reconsider its findings and a revised report be issued."

Sayen contended:

- The Board's report ignored the possibility of automatic feathering malfunctions despite the fact that many such defects were found on similar aircraft when checked following the accident. Added to that, approved procedures supplied to pilots for handling engine fires prior to the accident disarmed the auto-feathering circuitry, which in effect made the aircraft unairworthy due to lack of performance which accompanies the drag of a windmilling propeller.
- The CAB report stated that wind direction and weather had no bearing on the accident. This despite the fact that the wind was reported as downwind both before and after the accident. This detrimental condition to takeoff was unknown to the pilot since CAA personnel in the airport's control tower had reported a calm wind. The terrain to the southeast, the direction from which the wind was blowing, would have been favorable to the takeoff, since it is lower. The advantage of the wind in the nose of the plane and the lower terrain could have given the flight crew time to cope with the emergency and successfully circle the airport for an emergency landing.
- The CAB ignored a report of engine failure. Testimony by a passenger of the plane pointed to a sputter or irregularity during takeoff roll, indicating a power loss. Also, the two pilots during the hearings noted that power failure occurred in the plane's left engine.

Sayen contended that as a result of this accident, new procedures have been developed; had these been known prior to the accident it may have been prevented.

CASE HISTORY 1

REQUIRED:
A dependable supply of this small, machined electrode to meet customer's quality and quantity needs at reduced cost

HASSALL SOLUTION:
Hassall-designed re-heading process involving no critical dimension changes, resulted in a 59% cost reduction to customer.

CASE HISTORY 36

REQUIRED:
Less costly manufacturing method for this small stainless steel fluted pin which cost $19.20 per M as a screw machine product

HASSALL SOLUTION:
Cold forming by Hassall at a cost of $2.95 per M gave the customer an 85% cost reduction on this part

CASE HISTORY 89

REQUIRED:
Customer lacking for low cost, high production rate method of producing mandrels for rotary dental brushes.

HASSALL SOLUTION:
Hassall-originated design for cold-heading replaced for chamfered end with tumbled, round end, maintained rigid specifications for straightness and made low-cost production possible

CASE HISTORY 37

REQUIRED:
Bumper bolt with bonded rubber cap for license plate support

HASSALL SOLUTION:
The large head on this bolt would ordinarily call for screw machining but the two lugs under the head ruled this out. Progressive cold-heading was Hassall's answer.

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tion, placed his right hand on the control column and reached forward with his left hand for the zone 2 firewall shutoff lever.

Left Wing Strikes

The aircraft continued to yaw to the left and started sharply banked to the left despite attempted strong corrective control. At about that time the left wing struck the ground and the crash resulted. The maximum altitude reached from takeoff to impact was variously estimated as in the neighborhood of 100 feet. The total elapsed time was about 40 seconds of which about 25 seconds were used in the takeoff roll. The time interval from the start of the difficulty to the crash was only approximately 10 seconds.

Items 1 through 4 of TWA's Martin 404 emergency checklist under "Power Plant Fire-Failure" (meaning fire or failure) is as follows:

1	Throttle	Closed
2	Mixture	Off
3	Prop	Feather
4	Live Eng.	Meto Power

The Martin 404's autofeathering system is actuated by a substantial drop in the BMEP sustained over a period of at least two tenths of a second. The principal reason for the use of autofeathering is to provide a nearly instantaneous feathering upon significant power loss during or immediately following takeoff. It is an extremely important safety device to prevent quickly the insurmountable heavy drag associated with a windmilling propeller during takeoff. It is ordinarily deactivated except during takeoff.

The autofeathering toggle switch on the overhead panel when placed in the on position supplies electrical current to the arming switches in the throttle quadrant. The movement of the throttle forward from closed position beyond these switches arms the system for autofeathering. Movement of the throttle aft of the switches unarms the system (at about 42" manifold pressure).

The switches are located at a point in the throttle travel approximately one inch rearward of where the throttles normally would be after the first power reduction.

An attempt to reconstruct the flight from the testimony of witnesses leads to the belief that the aircraft banked to a near 45 degree position prior to ground contact and that recovery from the bank and turn was under way at impact.

Subsequent flight tests were conducted on a Martin 404. At 6,000 feet msl operating at Meto power and 125 knots IAS the left throttle was retarded abruptly to a zero thrust position and the aircraft yawed sharply about 30 degrees to the left. The aircraft was allowed to bank to the left about 45 degrees.

Recovery Made

Speed dropped abruptly to 105 knots, at which time nearly full right rudder and right aileron were applied. When power was returned to normal a full recovery was made. The test was not exactly representative of the flight involved because of different gross loads. However, the simulation was close enough to indicate

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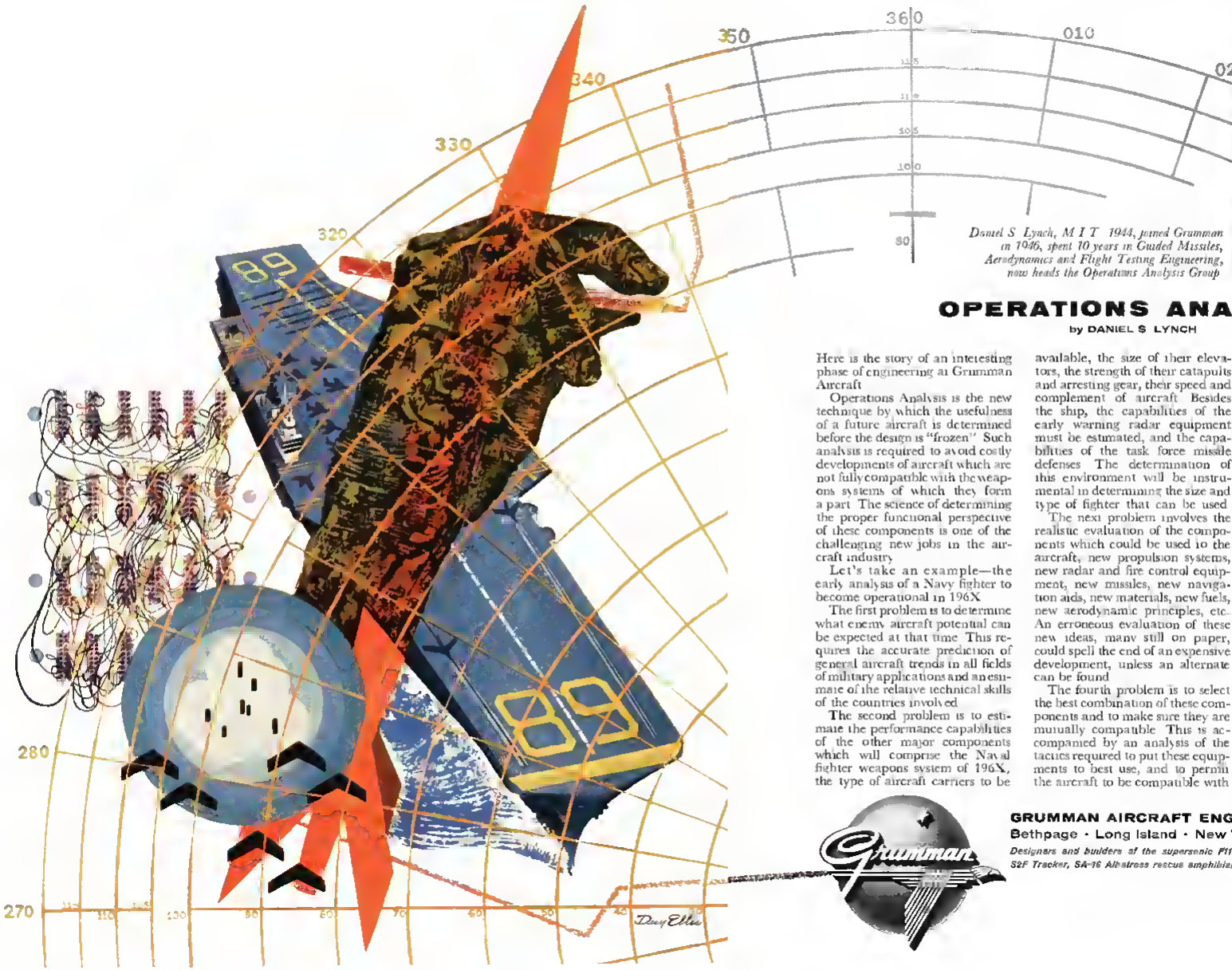
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Daniel S Lynch, M I T 1944, joined Grumman in 1946, spent 10 years in Guided Missiles, Aerodynamics and Flight Testing Engineering, now heads the Operations Analysis Group

OPERATIONS ANALYSIS

by DANIEL S LYNCH

Here is the story of an interesting phase of engineering at Grumman Aircraft

Operations Analysis is the new technique by which the usefulness of a future aircraft is determined before the design is "frozen" Such analysis is required to avoid costly developments of aircraft which are not fully compatible with the weapons systems of which they form a part The science of determining the proper functional perspective of these components is one of the challenging new jobs in the aircraft industry

Let's take an example—the early analysis of a Navy fighter to become operational in 196X

The first problem is to determine what enemy aircraft potential can be expected at that time This requires the accurate prediction of general aircraft trends in all fields of military applications and an estimate of the relative technical skills of the countries involved

The second problem is to estimate the performance capabilities of the other major components which will comprise the Naval fighter weapons system of 196X, the type of aircraft carriers to be available, the size of their elevators, the strength of their catapults and arresting gear, their speed and complement of aircraft Besides the ship, the capabilities of the early warning radar equipment must be estimated, and the capabilities of the task force missile defenses The determination of this environment will be instrumental in determining the size and type of fighter that can be used

The next problem involves the realistic evaluation of the components which could be used in the aircraft, new propulsion systems, new radar and fire control equipment, new missiles, new navigation aids, new materials, new fuels, new aerodynamic principles, etc. An erroneous evaluation of these new ideas, many still on paper, could spell the end of an expensive development, unless an alternate can be found

The fourth problem is to select the best combination of these components and to make sure they are mutually compatible This is accompanied by an analysis of the tactics required to put these equipments to best use, and to permit the aircraft to be compatible with the fleet from which it will operate

Only now is the design of the aircraft started, and task of the Preliminary Design Department, of which the Operations Analysis is a part, is to evolve the best structural and aerodynamic configuration which will derive the needed performance in the most economical, simple, and reliable fashion Concurrent with these physical design studies, The Operations Analysis Group analyzes the tactical performance capabilities with simulated combat problems on automatic computing machinery

From these combined design and analytical studies evolves an aircraft preliminary design which can be undertaken and proposed to the Military with a high level of confidence in its suitability to the job to be done

There is always opportunity for outstanding young engineers to join the fascinating work of Grumman's Operations Analysis Group. The Operations Analysis Group is one of many interesting phases of engineering at Grumman These phases have one thing in common. They all point to the future

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Designers and builders of the supersonic F11F-1 Tiger transonic F9F-8 Cougar S2F Tracker, SA-16 Albatross rescue amphibian, metal boats, and Aerobili truck bodies

that the subject aircraft underwent substantially the same motions

Testimony indicated that the Martin 404 aircraft with a gross load similar to that of the aircraft involved, with landing gear extended, with takeoff flaps, and with a windmilling propeller has a negative rate of climb

The crash site was about 1 260 feet beyond the runway and about 1 140 feet to the left of its extended centerline, i e , about 1,690 feet from the end of the runway at an angle of about 42 degrees to the left

The ground at that point is generally rolling and the aircraft struck on the far or upsloping side of a slight hollow

First impact with the ground was with the tip of the left wing while the aircraft was steeply banked to its left A study of wreckage and ground marks indicates that this bank was approximately 35 degrees The general direction of impact was about 130 degrees or about 50 degrees to the left of the direction of takeoff from runway 23 As the aircraft cartwheeled up a small incline, the left wing disintegrated and the wreckage came to rest with the right wing elevated This resulted in fuel from the ruptured fuel tanks of the right wing flowing down and under the shattered fuselage feeding a fierce gasoline fire and quickly trapping many occupants Investigation revealed no evidence of fire prior to impact.

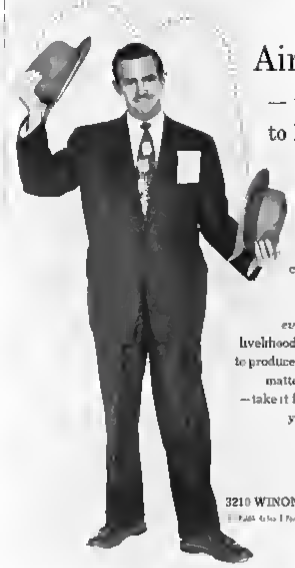
Mechanical Checks

Examination of the airframe disclosed no indication of a mechanical failure prior to impact with the ground The aileron boost control mechanism was beneh checked and was found normal other than from impact and fire damage The flaps were determined to have been at the takeoff position of approximately 12½ degrees at time of impact

All three landing gears were found down despite the fact that the captain stated they were started up at the proper time after breaking ground The right propeller blades were found in takeoff pitch position The left propeller blades were found against the low pitch stops which would cause maximum drag (while windmilling)

Tests of the engines propellers, and their components did not disclose any indications of mechanical failure or malfunction that would have resulted in a power loss Very comprehensive tests were conducted and some discrepancies were noted such as a broken inner intake valve spring and a ruptured carburetor deriehment valve diaphragm A power loss could not be duplicated by several types of tests made duplicating the latter condition

The exhaust system was inspected for indications of any burned section of openings and the only discrepancy noted was the left lower 'Y' section exhaust connector clamp which was fractured and gaping open adjacent to the welded area of its securing belt bosses The manufacturer had installed a Fenwal overheat pickup unit in close proximity to each of the connector outlet "Y" clamps The unit involved had a coating of soot in the interior of the scoop and on the pickup



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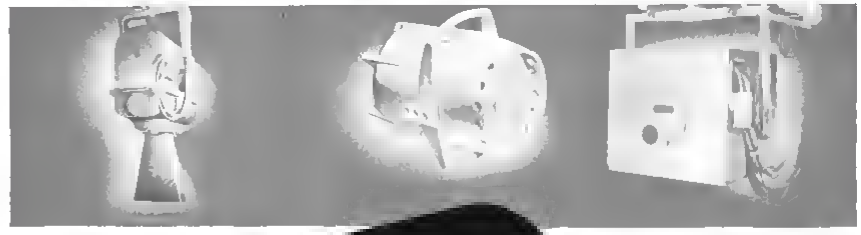
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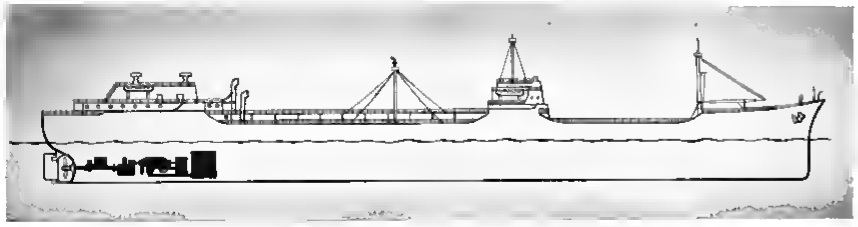
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A CCGCR propulsion system as it would appear in a tanker.

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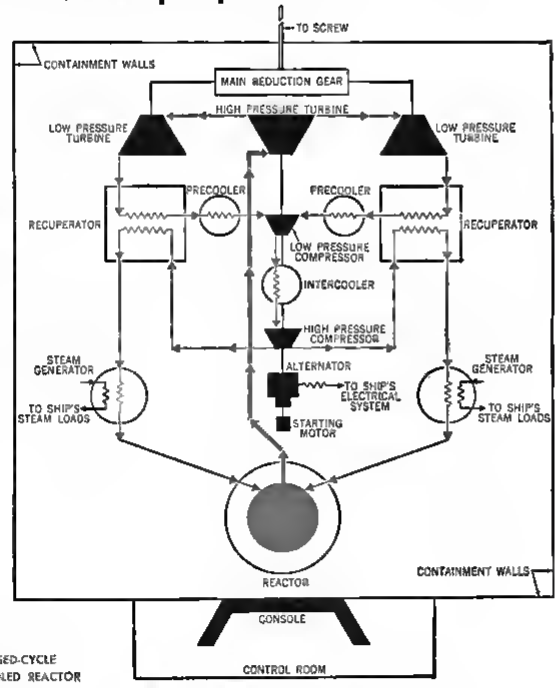
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Simplified Flow Diagram showing major components of ship propulsion system

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unit. It was subsequently tested and found to be operating properly.

Subsequent laboratory tests have confirmed that there was an appreciable interval of time in which the fractured surfaces of the clamp had been exposed to combustion exhaust gases resulting in a scale deposit similar to other exposed surfaces. These fractured surfaces were not exposed to ground fire.) There was slight evidence of fatigue failure even though the positive indications of such are not as pronounced after exposure to high temperatures.

At the time the clamp was inspected, approximately 127 hours prior to the accident (at the time of the second prior 100 hour inspection), a record of a cracked clamp was observed and written up by inspection, there is no record of its condition at the last 100 hour inspection, 27 hours before the accident.

These clamps are partially hidden by exhaust stack covers which remain in place when the accessory cowling is removed, with the result that the clamps are not open to thorough examination except at their scheduled 100 hour inspections when the stack covers as well as the accessory cowling are removed.

The type or design of the welded bolt securing boss area is conducive to stress concentrations as evidenced by the laboratory analysis of this particular clamp. This was the only clamp broken even though the exhaust collector ring on the other engine was much more damaged by impact.

The official U. S. Weather Bureau records indicate that the last observation before the accident, at 1900, included an east wind of 8 knots. The official Weather Bureau special observation taken immediately after the accident, at 1923, included an east wind of 7 knots, both observations giving 5 miles of visibility with scattered clouds at 7,000 feet and 20,000 feet.

The "calm" given the flight just before takeoff by the control tower was from the tower's own wind recording instrument and carried with it the arbitrary meaning that the wind was 6 knots or less. This slight difference had no bearing on the accident nor did other weather conditions.

ANALYSIS

It is not possible to determine just when the subject exhaust connector clamp failed. It is possible that this clamp, whether it was the old cracked one or a replacement, could have failed during the flight from Newark on the day of the accident and have shifted so that during the takeoff at Pittsburgh the collector ring mating connections separated just enough for escaping exhaust to impinge on the Fenwal unit scoop, deposit the observed soot, and signal a fire warning. It has happened on other occasions at this particular location.

Presumably, the clamp was replaced at the time of the second prior 100 hour inspection and the replacement was found satisfactory at the time of the last 100 hour inspection. The subject clamp has been a troublesome and costly maintenance item and the carrier has changed designs several times.

Currently the carrier is conducting ser-

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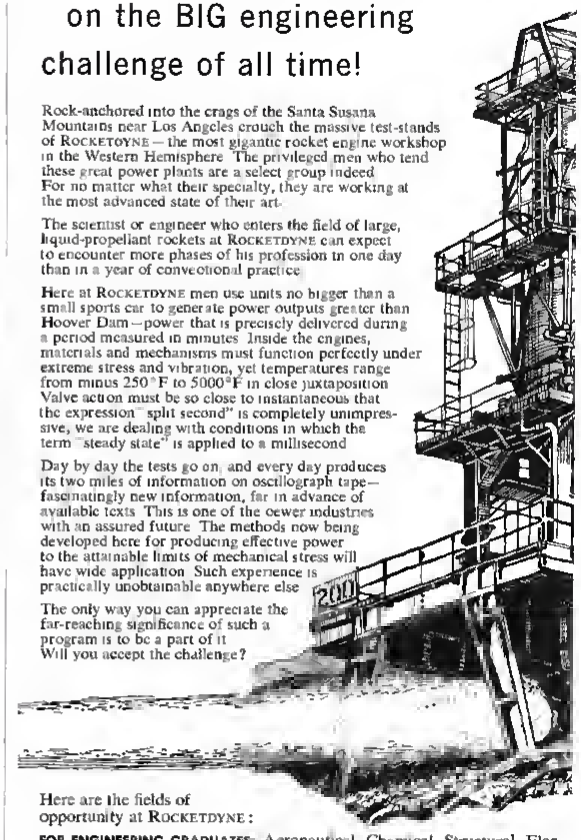
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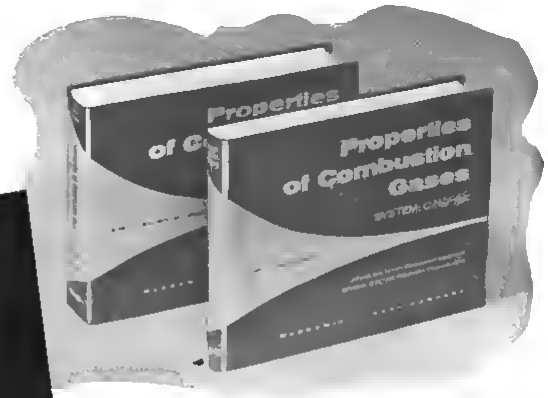
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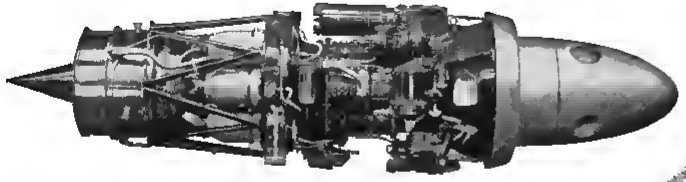
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SAFETY

vice tests on a new type in its continuing efforts to find a satisfactory clamp. As a result of this accident the Board recommended more frequent inspections of the exhaust system and the carrier has agreed to do so.

As mentioned, First Officer Jespersou saw the fire warning light flicker. He either reduced the left throttle in compliance with the first item on the Martin 404 cockpit checklist under the heading "Power Plant Fire Failure" or he diverted his attention from throttle movement to the fire warning light and inadvertently pulled the throttle sufficiently rearward to unarm the autofeathering. Because he testified that he did not recall moving the throttle rearward it seems more than likely that he did so intuitively when his attention was diverted by the fire warning light.

Captain McQuade on the right did not see the zone 1 fire warning light and only noted the BMEP gauge indicate power loss (which in all probability was the result of Jespersen's retarding the left throttle). McQuade pulled the mixture to idle cutoff. The throttle having been retarded did allow automatic feathering only windmilling thus setting up excessive drag and yaw to the left.

Since Captain McQuade attempted to obtain autofeathering by pulling back the mixture lever it is apparent that he neither knew the left throttle had been retarded to a point where autofeathering was inoperative nor did he expect this action by the first officer, despite such action being called for in the company's emergency checklist for "Power Plant Fire Failure."

Yaw Aggravated

It is believed that the yaw to the left was first experienced when the left throttle was pulled aft and this yaw was violently aggravated by the windmilling of the left propeller brought about with the captain's movement of the left mixture control to the idle cutoff position.

In reference to the landing gear handle being found up, the captain may have raised the landing gear handle out of neutral position but not sufficiently upward to open the hydraulic valve for gear up operation. The gear up action probably was interrupted by the captain directing his attention to the drop in BMEP and the yaw. This would account for the landing gear being found in the down position at the time of impact. There appears to be no explanation of why Captain McQuade did not see the fire warning light.

Testimony of TWA's chief pilot for the Atlantic Region was that under similar circumstances he would not as his first act have pulled the left throttle back to the point where it disarmed the autofeathering feature. He felt that the wisest procedure under these critical circumstances would have been temporarily to ignore the fire warning (particularly as it was a zone 1 warning) until enough altitude and speed were obtained to ensure single-engine flight.

This opinion was shared by Captain McQuade. However, an emergency checklist had been provided to apply in the event of either a zone 1 fire or loss of

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power. The first officer started execution of this checklist but as he was reaching to feather the propeller manually, the captain interrupted his action believing that autofeathering would take place. It is logically concluded that had the first officer continued as prescribed, the left propeller would have feathered. The complexity of modern aircraft and coordinated efforts required by multiple crews in an emergency dictate that all procedures must be carried out in strict conformity to prescribed checklists.

The Board must conclude that each pilot reacted to the emergency as he understood the emergency but, as the two pilots had not full common knowledge of what was happening nor precisely what the other was doing, the resulting joint and uncoordinated actions resulted in a windmilling propeller making the aircraft unflyable under the circumstances.

To minimize the possibility of any recurrence of this nature the carrier, after the accident, modified its emergency procedures for powerplant fire or failure. These revised procedures specify that the crew member who first observes the difficulty shall call out the emergency so that the captain can initiate immediate coordinated action by the crew. After it has been determined which engine has the fire or failure, the propeller is to be manually feathered before the throttle is closed or the mixture is cut. If the emergency occurs during takeoff and autofeathering has not taken place by the time propeller has been made, the propeller is to be feathered manually by pushing the feathering button.

FINDINGS

On the basis of all available evidence the Board finds that:

1. The crew, the aircraft, and the operator were currently certificated.
2. Dispatching was routine.
3. Engine runup and the takeoff roll were normal.
4. At the time of the first power reduction the first officer saw the left engine zone 1 fire warning light come on and retarded the left throttle to a point where autofeathering was deactivated.
5. The first officer then reached for the left manual feathering button but was dissuaded from using it by the captain who, not knowing that the autofeathering was inoperative, attempted futilely to obtain it by pulling back the left mixture to idle cutoff.
6. This action did not comply with the emergency procedures prescribed by the carrier for powerplant fire or failure.
7. Although these were not the most desirable procedures, compliance without delay would have feathered the left propeller.
8. The windmilling left propeller, the extended landing gear and the takeoff flaps produced sufficient drag to make the airplane lose altitude and strike the ground.
9. The cause of the fire warning was a failed exhaust connector clamp in the left engine which triggered an adjacent fire detecting unit.
10. After the accident the carrier revised

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its emergency procedures for powerplant fire or failure.

PROBABLE CAUSE

The Board determines that the probable cause of this accident was uncoordinated emergency action in the very short time available to the crew, which produced an airplane configuration with unsurmountable drag.

By the Civil Aeronautics Board:

/s/ James R. Durfee
/s/ Harmar D. Denny
/s/ G. Joseph Minetti

Adams, Vice Chairman, and Gurney, Member, did not participate in the adoption of this report.

SUPPLEMENTAL DATA

The Civil Aeronautics Board received notification of the accident at 1945, April 1, 1956. An investigation was immediately initiated in accordance with the provisions of Section 702 (a) (2) of the Civil Aeronautics Act of 1938, as amended. As part of the investigation a public hearing was held at Pittsburgh, Pennsylvania, on May 7 and 8, 1956, and depositions of the pilots were taken at Newark, New Jersey, on June 12, 1956.

Air Carrier

Trans World Airlines, Inc., a Delaware corporation, is a scheduled air carrier with its principal offices at Kansas City, Missouri. It possesses a currently effective certificate of public convenience and necessity issued by the Civil Aeronautics Board and an air carrier operating certificate issued by the Civil Aeronautics Administration. These certificates authorize the carrier to transport by air persons, property, and mail over various routes, including that between Pittsburgh, Pennsylvania, and Newark, New Jersey.

Flight Personnel

Captain Raymond F. McQuade, age 33, had been employed by TWA since 1944. He had satisfactorily completed a company course of training for first officer and was promoted to that position in 1945, and promoted to captain Sept. 1949. He completed Martin equipment qualification as captain on Oct. 6, 1953. Captain McQuade was appointed line check pilot in February 1956 after satisfactorily completing the requisite company course. He held a valid airman certificate with airline transport pilot and all other pertinent ratings and had flown a total of 12,000 hours, of which 2,200 hours had been in Martins. Since becoming a line check pilot he had flown a total of 105 hours, of which 46 hours had been spent performing the duties of a line check pilot. His test period prior to the flight had been in compliance with CAA requirements.

First Officer Harlan V. Jesperson, age 41, was first employed by TWA in 1944 as a pilot navigator. He completed the requisite training and became a first officer February 20, 1946. He checked out as first officer on Martins December 13, 1955. He was assigned to the company's training department for upgrading to captain in February 1956.

At the time of this accident Mr. Jes-



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SAFETY

person was being line-checked for advancement to captaincy

He held a valid airman certificate with airline transport pilot and all other pertinent ratings His total flying time was 7,145 hours, of which 204 had been Martins, and his rest period prior to the flight had been in compliance with CAA requirements

Hostess Mary Jane Fanning, age 21, was first employed by TWA as a student hostess January 3, 1956

She had satisfactorily completed the requisite company training courses on emergency procedures

The Aircraft

N 40403 a Martin 404, was manufactured in November 1951 It had a total time of 9,177 hours, of which 836 had been since overhaul Times since overhauls of both engines and both propellers were within the CAA's time limits A study of its log sheets for the preceding 30 days and the last eight line maintenance records disclosed no pertinent discrepancies

Certificates of Necessity

Douglas Aircraft Company, Inc., has been awarded an $18,767,800 certificate of necessity for accelerated tax amortization by the Office of Defense Mobilization for aircraft facilities. Of the total amount, 60% has been allowed at the rapid rate Other certificates awarded were

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General Electric Co., Schenectady, N. Y., research and development $878,000 certified with 55% allowed; Lynn, Mass., research and development $905,140 certified with 65% allowed

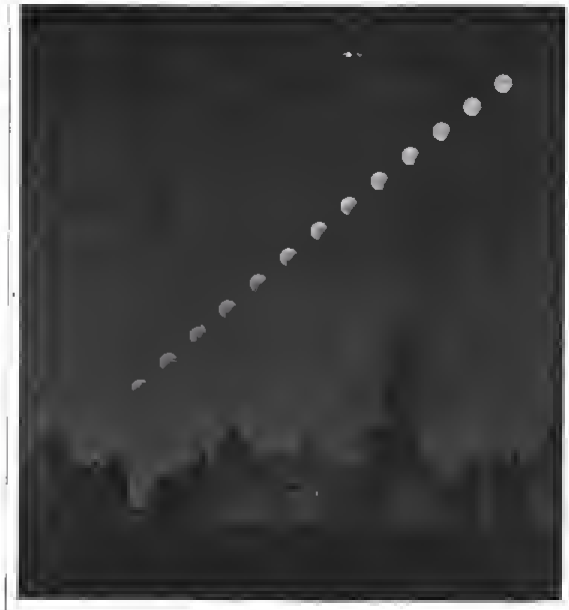
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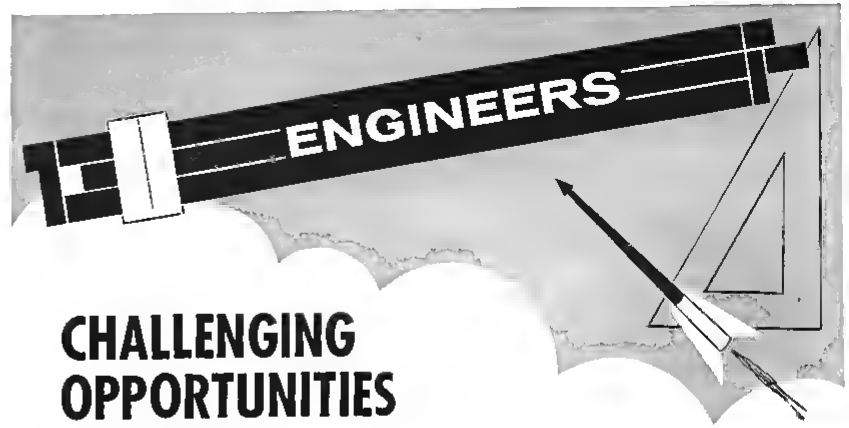
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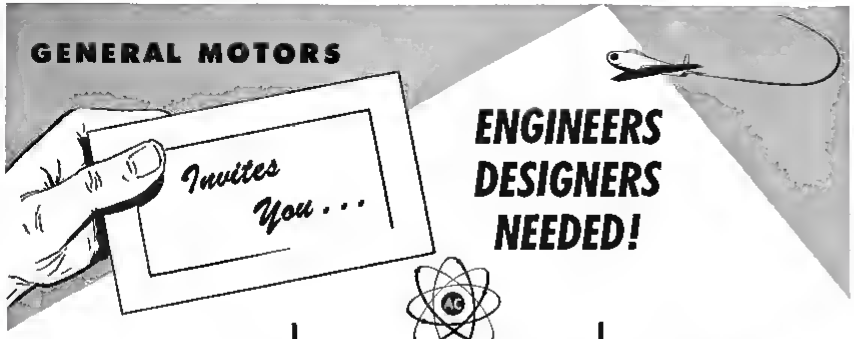
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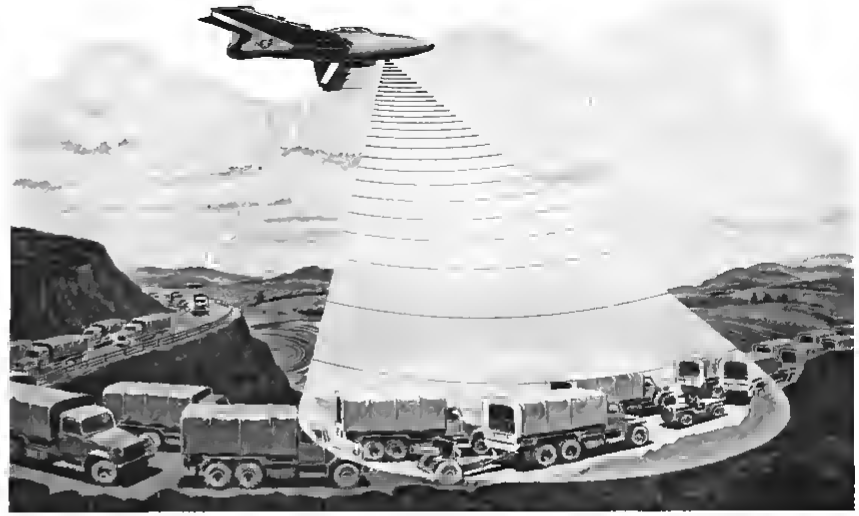
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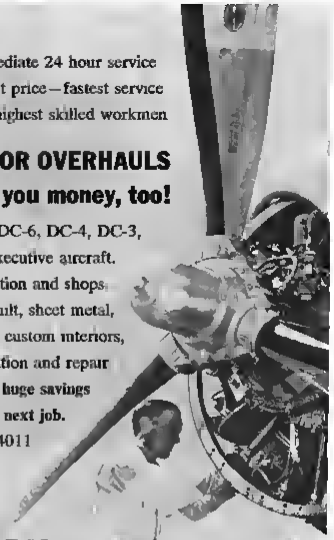
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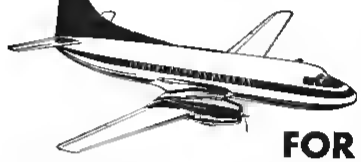
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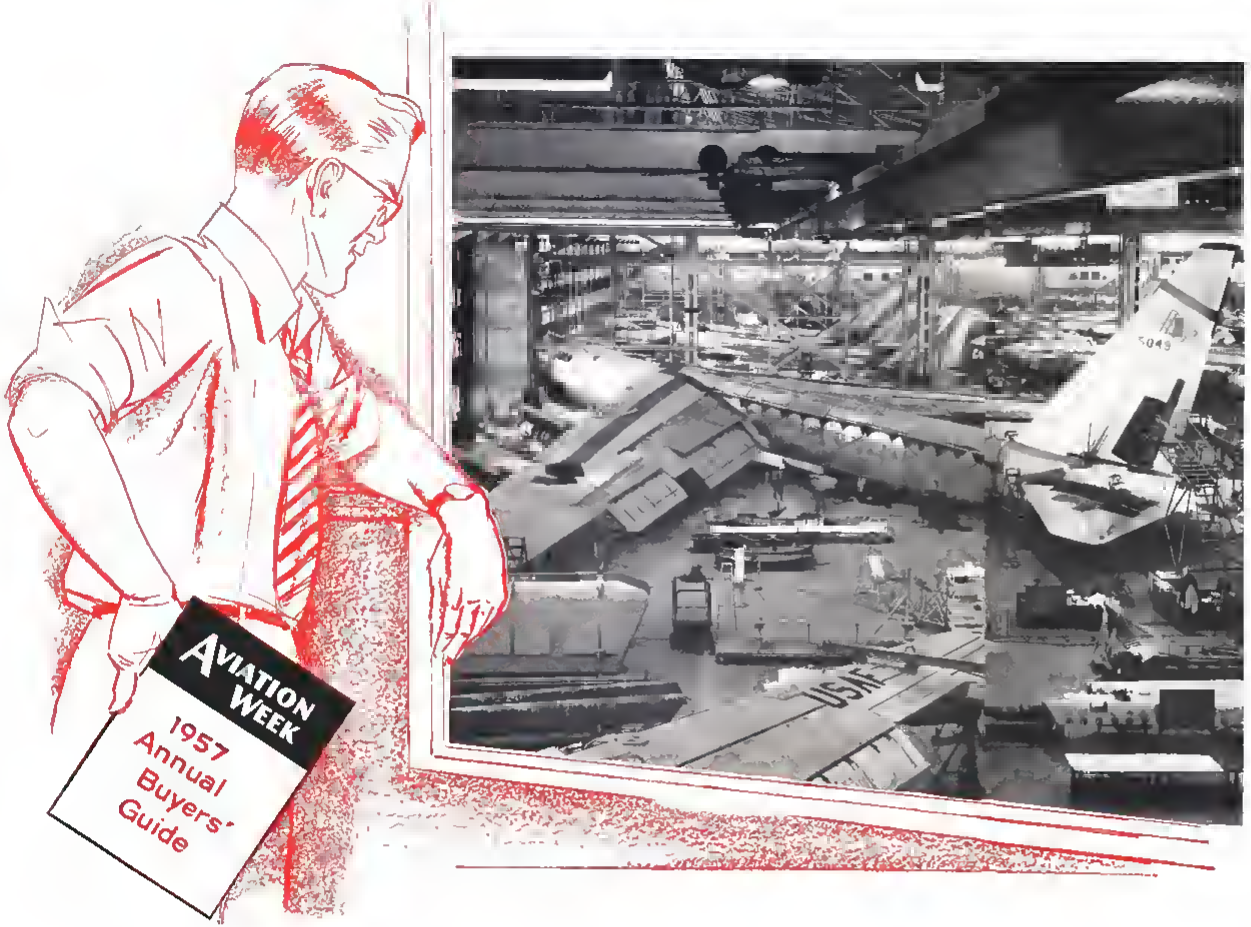
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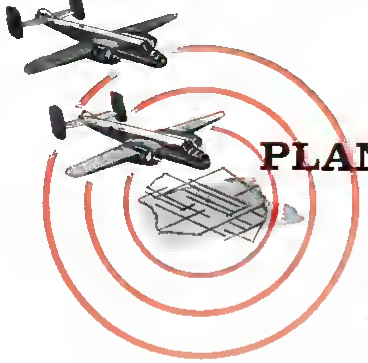
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LETTERS

VFR Minimums

I have always been reluctant to enter into letter writing on a controversial subject such as the one now going on in connection with our air traffic control. It does occur to me, however, that in most instances, the private pilot is being made the target for troubles with which he has no connection at all. I am not a private pilot. I do fly a corporate plane. Most corporate pilots today are ex-airline pilots and are professionals. Jack Gandy, pilot of the ill-fated TWA Constellation, was a friend of mine. I have flown with him in the past. He was a competent pilot, alert and able.

The ALPA has recommended raising the VFR minimums immediately following the Arizona accident. It would be just as logical to suggest raising the VFR minimums because of the Air France accident, which happened some time ago and tied up traffic for quite a while before the plane crashed, or to point a finger at the private pilot because of the accidents which occurred at Elizabeth, New Jersey, and closed down the Newark Airport.

It would be just as logical to stop or control more closely private boating because of the SS Stockholm-Andrea Doria accident, or to curtail automobile drivers because a Greyhound Bus was involved in an accident with another bus.

The result of imposing IFR rules to all aircraft today would curtail private or business flying and create more problems—

1. Because of experience or qualification reasons.

2. Because even those properly qualified, knowing the additional time required for flight plans, clearances, etc., would abandon short flights in favor of automobile or train.

3. Because the CAA admittedly does not have trained men or equipment to handle the tremendous additional load that would be created.

4. Because there would be more confusion, more congestion, more missed approaches by pilots arriving at unfamiliar airports—ad infinitum.

5. Because there would be outlaw flying from farms, out-of-the-way airports, etc.—a situation similar to the Eighteenth Amendment—a law created to be broken with not enough policing, regardless of appropriations to enforce compliance.

What then, is the answer to this pressing problem?

1. Better visibility in the airliner cockpit. Rate of closure had nothing to do with the Arizona accident—both planes were propeller driven craft going the same way. Given the visibility of a Bonanza, that accident would not have occurred!

2. The answer could be a "bubble" enclosure with a third crew member as observer—in that manner at least one man would have his head "out of the cockpit." Presently, the airliner crew, by the very multiplicity of instruments, controls and required radio contacts, must have their heads "in the cockpit" much of the time. To pursue the thinking of some writers regarding controlled flight, the crew would only need a couple of port holes directly in front of their seats for take off, final approach and touch down. In this controlled flight era in this "dream world" of errorless control, it would be impossible to have a collision—we might ultimately do away with the pilot (and the ALPA)—just train key punch operators to push the right buttons—even the button pushers could be replaced with automatons!

Seriously, we should implement our present control as rapidly as new men are trained and new up-to-date equipment is readied for use—our private pilots, business pilots and airline pilots should be educated to the use of these added facilities and do their duty to "keep alert and watch for other traffic" and finally, we should not every time an accident occurs, seek to divert attention from our own shortcomings by pointing a finger at the other fellow. Private planes have caused disruptions around busy terminals but so have airliners. The difference is it just isn't mentioned when it happens inside the family.

Airline pilots don't get those ATR's without having served an apprenticeship on smaller, slower equipment and having passed over the same route being taken today by our fledglings—our airline pilots of tomorrow. Let's require more ability on the part of our student and private pilots if need be, and as equipment and personnel are available add, if needed, higher minimums, but for goodness sake, let's not let a small organized minority dictate a set of rules which might forever hobble and curtail the majority of the flying being done in this country.

W. H. Becker
Houston 2, Texas

Aviation Week welcomes the opinion of its readers on the issues raised in the magazine's editorial columns. Address letters to the Editor, Aviation Week, 330 W. 42 St., New York 36, N. Y. Try to keep letters under 500 words and give a genuine identification. We will not print anonymous letters, but names of writers will be withheld on request.

Flight Engineer's Job

Congratulations to the United Flight Officer (Letters, AW July 30, p. 102) who is about to realize a life-long ambition—to become a copilot.

However, in his exuberance he left an impression on many a reader that if would like to square away. For prestige and pay purposes the flight engineer is in every respect (on most airlines) equal to the copilot. Most flight engineers are not in the least interested in changing their occupations and becoming pilots. Yet they too enjoy flying—and many of them—myself included—fly light planes for kicks. Flight engineering and piloting are two different occupations. They compliment each other, not supplement.

A flight engineer's station was provided for by law for this reason: the complicated systems of a large aircraft imposed too great a load on the pilot's capacity to perform their duties with an appropriate degree of safety.

Let's consider what is meant by an "appropriate degree of safety." Does it mean merely relieving the pilots of the necessary cockpit chores as involved in the routine manipulation of switches, throttles, mixtures, etc.? Hardly. If all flights were devoid of malfunctions and emergencies this might suffice. It might suffice if all malfunctions and emergencies were of a stereotyped nature such as is found in most operating manuals where Step 1, Step 2, etc., can be performed by rote and the situation corrected or nullified.

Unfortunately, the stereotyped malfunction rarely occurs. To obtain "an appropriate degree of safety" the flight engineer must be an expert maintenance man who can interpret malfunctions, trouble shoot systems and prescribe preventive maintenance before the emergencies arise. He must possess the knowledge to make maintenance decisions that will allow a flight to continue without inconvenience to the passengers and without jeopardizing their safety.

Most of us are ex-maintenance men. All of us should be. Safety and airworthiness require judgment and knowledge that can best be gleaned from a well-used tool box. How many times do captains turn around and say, "Well, engineer, what do you think?"

A lot of thinking can go into all the problems that develop in 100,000 lb. of machinery. And only an individual who is conditioned to this type of thinking, who really knows and likes airplanes (not flying), can support his share of the responsibility to the flying public.

There are a few individuals who sit in the flight engineer's seat by virtue of a few weeks training and a few C.A.R. that permits such nonsense—thanks to some lopsided reasoning that this is:

- A quick, economic way to beat an existing C.A.R. (that an F.E. must be carried on some aircraft).
- A handy way to indoctrinate aspiring copilots.
- A potentially good spot to stick older pilots who can no longer pass a Class 1 physical.

These people are in the minority. For the sake of air safety, I hope the balance does not swing the other way. The flight engineer's seat is no place for a light plane pilot with a few weeks training as an F.E.

W. T. Northacker, Flight Engineer
Blue Point, N. Y.

WADC System

I want to compliment you on your recent articles on the WADC instrument system (AW Aug. 6, p. 275). The articles were excellent. I recently visited Wright Field and was given the complete treatment by the Flight Controls Lab on the system. I found that your articles very accurately describe the philosophy and thinking behind the instrument system.

R. P. Snowgrass, Director, Flight Research
Sperry Gyroscope Co., Great Neck, N. Y.

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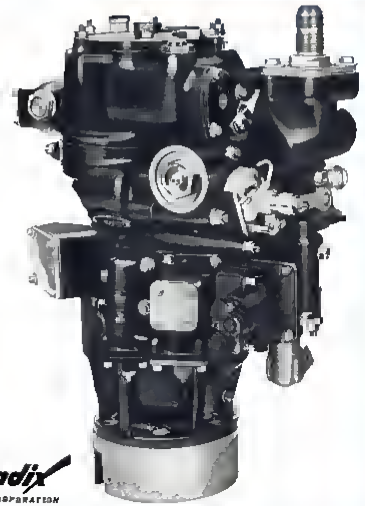
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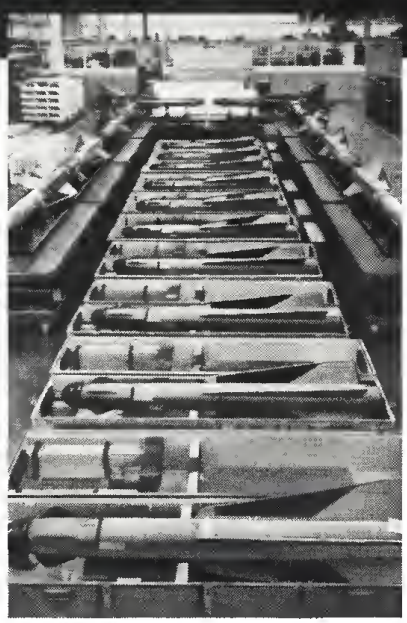
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